

IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OHIO
EASTERN DIVISION

IN RE NATIONAL	:	MDL No. 2804
PRESCRIPTION OPIATE	:	
LITIGATION	:	CASE NO. 1:17-MD-2804
Lake County and Trumbull	:	
County, OH Case	:	

EXPERT REPORT OF CRAIG J. MCCANN, PH.D., CFA

April 16, 2021

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I. Qualifications and Remuneration

A. Qualifications

1. I am the President of Securities Litigation and Consulting Group, Inc. (“SLCG”). SLCG was founded in 2000 to apply finance, economics, statistics and mathematics in litigation and consulting. SLCG staff includes professionals with PhDs and advanced degrees in applied mathematics, statistics, finance and economics.

2. Prior to founding SLCG, I was a Director at LECG, a business unit of Navigant Consulting, Inc. Prior to joining LECG, I was Managing Director, Securities Litigation at KPMG LLP for two years. I was a senior financial economist in the Office of Economic Analysis at the U.S. Securities and Exchange Commission (the “SEC”) from 1992 to 1993 and from 1994 to 1995.

3. I have taught graduate economics and finance courses at the University of South Carolina, Virginia Tech, Georgetown University and at the University of Maryland, College Park.

4. I have been hired as a consultant and expert witness in investigations by many state and federal agencies including the SEC, the Federal Deposit Insurance Corporation and the U.S. Department of Justice.

5. My work as a consultant and expert witness over the past 25 years has required me to extract or receive data, process and validate the data and produce varied statistical analyses.

6. I earned a Ph.D. in Economics from the University of California, at Los Angeles. My graduate studies included extensive coursework in mathematics, statistics and econometrics.

7. My resume, which includes a list of all publications authored by me within the last 10 years and the cases in which I have testified as an expert at trial or by deposition within the last four years, is attached as Appendix 1.

8. I previously provided expert testimony on substantially the same issues discussed below through written reports and depositions in *In Re National Prescription Opiate Litigation* more fully identified in my resume.

B. Remuneration

9. SLCG is being compensated for its time and expenses. My hourly rate is \$475 per hour. Other SLCG personnel working on this matter have billing rates of \$100 to \$395 per hour.

II. Materials Considered

10. In preparing this report, I have considered the following documents:

- a. Automation of Reports and Consolidated Orders System (“ARCOS”) electronic data, received from the Drug Enforcement Administration (hereafter, “ARCOS Data”);
- b. “ARCOS Retail Drug Summary Reports,” Drug Enforcement Administration, 1997-2019, (available at www.deadiversion.usdoj.gov/arcos/retail_drug_summary/index.html);

- c. “National Drug Code Dictionary,” Drug Enforcement Administration, accessed in November 2018 and January 2020 (current version available at www.deadiversion.usdoj.gov/arcos/ndc/ndcfile.txt);
- d. “NDC Dictionary Instructions,” Drug Enforcement Administration, October 2010 (current version available at www.deadiversion.usdoj.gov/arcos/ndc/readme.txt);
- e. “NDC/NHRIC Labeler Codes,” U.S. Food & Drug Administration, January 2018 (current version available at www.fda.gov/ForIndustry/DataStandards/StructuredProductLabeling/ucm191017.htm);
- f. “Opioid Oral Morphine Milligram Equivalent (MME) Conversion Factors,” Centers for Disease Control and Prevention, August 2017 (current version available at www.cdc.gov/drugoverdose/resources/data.html);
- g. “Full Replacement Monthly NPI File,” Centers for Medicare and Medicaid Services, December 2019 (current version available at download.cms.gov/nppes/NPI_Files.html);
- h. ARCOS Registrant Handbook, Drug Enforcement Administration, August 1997 (current version available at www.deadiversion.usdoj.gov/arcos/handbook/full.pdf);
- i. Masters Pharmaceutical, Inc. v. Drug Enforcement Administration, 861 F.3d 206 (D.C. Cir. 2017);

- j. U.S. Dep't of Justice, DEA, Chemical Handler's Manual: A Guide to Chemical Control Regulations (2004), (WAGMDL00395965);
- k. U.S. Dep't of Justice, DEA, *Diversion Investigators Manual* (1990) (CAH_MDL_PRIORPROD_DEA07_01176247);
- l. U.S. Dep't of Justice, DEA, *Diversion Investigators Manual* (1996) (CAH_MDL2804_02203353);
- m. Administrative Memorandum of Agreement (between DEA and Mallinckrodt);¹
- n. Defendants' Transactional Data (CVS-MDLT3-000009932, GE_TL00014980, Rite_Aid_OMDL_0146924, WAGMDL00851846, WMT_MDL_000254857 - WMT_MDL_000254870);
- o. Chain Pharmacy Defendants' Dispensing Data (hereafter, "Dispensing Data") (CVS-MDLT1B-000012531, CVS-MDLT1B-000012532, CVS-MDLT1B-000012533, CVS-MDLT1B-000012534, CVS-MDLT1B-000012535, CVS-MDLT1B-000012536, HBC_MDL00192642, Rite_Aid_OMDL_0064862, WAGMDLDATA00002, WMT_MDL_000071426);
- p. Suspicious Order Reports produced by the DEA (DEA_000000001(confidential_suspicious_trans_oh_wv_al_il_mi_fl_20060101-20141231.xlsx); SORS-000001 - SORS-2932);

¹ www.justice.gov/usao-edmi/press-release/file/986026/download

- q. Deposition of Thomas Prevoznik, April 17-18, 2019, May 17, 2019 and exhibits thereto;
- r. Lake Original Complaint, Lake Short Form Amended Complaint, Lake Supp. Amended Complaint, Trumbull Complaint, Trumbull Short Form Amended Complaint, Trumbull Supp. Amended Complaint;
- s. Discovery Ruling No. 12 Regarding Suspicious Order Interrogatory [Doc. 1174];
- t. Cardinal Health DEA Compliance Manual (CAH_MDL_PRIORPROD_DEA07_01383895);
- u. McKesson Operations Manual Lifestyle Drug Monitoring Program (MCKMDL00355251);
- v. Masters Pharmaceutical's Suspicious Order Management System (SOMS) algorithm (August 1, 2009 version), (CAH_MDL2804_01423581 to CAH_MDL2804_01423586)
- w. Other documents cited in the text and footnotes below.

III. Assignment

11. I have been asked by Plaintiffs' Counsel to document how I processed, validated and augmented opioid transaction data produced by the Drug Enforcement Administration ("DEA") and internal Transactional Data

(identified in paragraph “10.n” above) to attribute transactions with Dispensers² to Distributor Defendants and Chain Pharmacy Defendants.

12. I have been asked to summarize shipments in the ARCOS Data, especially those shipments into Lake County and Trumbull County, OH attributable to all the Defendants.

13. I have also been asked to report the results of applying certain algorithms to the ARCOS Data.

14. I have also been asked to document how I processed the Defendants’ Dispensing Data (identified in paragraph “10.o” above).

15. I have also been asked to summarize the Dispensing Data in Lake County and Trumbull County, OH attributable to the Chain Pharmacy Defendants.

16. I have also been asked to report the results of applying certain algorithms to the Chain Pharmacy Defendants’ Dispensing Data.

IV. Summary of Opinions

17. Based upon my comparison of the ARCOS Data produced by the DEA and the public ARCOS Retail Drug Summary Reports, I conclude that, after correcting a relatively small number of records as explained in more detail below, the ARCOS Data produced by the DEA is reliable.

18. I conclude that the ARCOS Data is reliable in part because it closely matches the DEA’s Retail Drug Summary Reports for January 2006

² As explained more fully below I use “Dispensers” to refer to businesses that dispense drugs to patients such as pharmacies and hospitals.

through December 2014. Retail Drug Summary Reports summarize the weight of drugs in reported transactions with consumers in each of the 50 states and the District of Columbia. Where there were discrepancies between the ARCOS Data produced by the DEA and the Retail Drug Summary Reports, I was able to identify and correct the error in either the ARCOS Data or the Retail Drug Summary Reports.

19. In Section V, I describe the ARCOS Data produced by the DEA and report national summary statistics for the ARCOS Data, after correcting minimal errors explained fully in Appendix 2. In addition, I compare the processed ARCOS Data to Retail Drug Summary Reports published by the DEA to verify that the shipments of opioids to dispensing outlets in the ARCOS Data are consistent with the amount of each opioid the DEA calculates was shipped into each 3-digit zip code each quarter.

20. In Section VI, I report summary statistics for subsets of the processed ARCOS Data covering Lake County and Trumbull County, OH. These summary statistics show that between 2006 and 2014, Dispensers in Lake County, OH received 100.9 million Dosage Units or 1.6 billion MME of opioids. Given the county's 229,550 average population during this same time period,³ Dispensers received enough opioids for every resident in Lake County, OH to consume 49 Dosage Units or 794 MME every year from 2006 to 2014. Between 2006 and 2014, Dispensers in Trumbull County, OH received 131.2 million Dosage Units or 2.6 billion MME of opioids. Given the county's 210,118 average population during this same time period,⁴

³ United States Census Bureau, <https://www.census.gov/>

⁴ United States Census Bureau, <https://www.census.gov/>

Dispensers received enough opioids for every resident in Trumbull County, OH to consume 69 Dosage Units or 1,349 MME every year from 2006 to 2014.

21. In Section VII and VIII, I describe a non-exhaustive set of algorithms that can be systematically applied to the ARCOS Data of each Distributor Defendant and each Chain Pharmacy Defendant, respectively.

22. In Section IX, I compare the ARCOS Data to the Chain Pharmacy Defendants' Dispensing Data produced in discovery.

23. In Section X, I describe a non-exclusive set of certain "flagging" algorithms that can be systematically applied to the Dispensing Data and the results of such application.

24. In Section XI, I describe certain charts and tables that are attached to this report. In Section XII, I summarize my conclusions.

25. I continue to review documents and gather information and reserve the right to update my analysis and opinions based upon that further review of documents and based on any new information including, possibly, reports of other experts - I may receive.

V. National ARCOS Data

26. ARCOS is the system through which manufacturers and distributors report transactions of controlled substances to the DEA.⁵ ARCOS Data covers all fifty states, the District of Columbia, Puerto Rico, Guam, U.S.

⁵ www.deadiversion.usdoj.gov/arcos/index.html, accessed on 29 November 2018.

Virgin Islands, American Samoa, and the Northern Mariana Islands, Armed Forces-Americas, Armed Forces-EMEA, Armed Forces-Pacific, and Palau.

A. Receipt of ARCOS Data from the DEA

27. In the multi-district litigation, the DEA produced a set of ARCOS Data reflecting transactions in drug products containing one or more of fourteen drugs: buprenorphine, codeine, dihydrocodeine, fentanyl, hydrocodone, hydromorphone, levorphanol, meperidine, methadone, morphine, powdered opium, oxycodone, oxymorphone, and tapentadol from January 1, 2006 through December 31, 2014.

28. On or about April 20, 2018, the DEA produced ARCOS Data reflecting transactions in oxycodone, hydrocodone, hydromorphone, and fentanyl for six states: Alabama, Florida, Illinois, Michigan, Ohio, and West Virginia. On or about May 20, 2018, the DEA produced transaction data for these four drugs for the remaining states. The May 20, 2018 production was missing pharmacy names and had some duplicate transactions and obvious errors. At my request, the DEA reproduced the May 20, 2018 data with pharmacy names and errors in the May 20, 2018 production largely corrected on or about June 5, 2018.

29. Additionally, the DEA produced ARCOS Data for all states for oxymorphone, tapentadol, buprenorphine, and morphine on or about July 6, 2018; for codeine, dihydrocodeine, meperidine, and powdered opium on or about July 24, 2018; and for methadone and levorphanol on or about August 28, 2018.

30. The timing and amount of ARCOS Data produced by the DEA are summarized in Table 1. In total, the ARCOS Data has 500,709,803 transaction records – 444,819,182 transaction records involving Dispensers.⁶

Table 1 ARCOS Opioid Transaction Data Produced by DEA

	Drug	# of All	Transactions with Dispensers				
	Code	Transactions	# of Transactions	Dosage Units	Dosage Units %	Calculated Base Weight	Calculated Weight %
Received June 5, 2018							
Hydrocodone	9193	189,611,242	174,829,777	74,285,510,348	53.04%	436,729,519	25.85%
Oxycodone	9143	116,411,941	106,210,465	39,978,942,635	28.54%	494,278,594	29.25%
Fentanyl	9801	51,159,276	42,971,667	914,488,221	0.65%	8,096,158	0.48%
Hydromorphone	9150	17,446,169	14,435,387	2,571,523,184	1.84%	15,161,478	0.90%
Subtotal		374,628,628	338,447,296	117,750,464,388	84.07%	954,265,749	56.48%
Received July 6, 2018							
Morphine	9300	49,243,546	39,880,848	6,365,919,333	4.55%	222,022,285	13.14%
Buprenorphine	9064	26,275,507	24,153,401	1,857,399,214	1.33%	152,570,080	9.03%
Oxymorphone	9652	6,033,613	5,008,054	633,293,763	0.45%	11,042,968	0.65%
Tapentadol	9780	3,376,288	2,827,854	353,918,908	0.25%	28,776,260	1.70%
Subtotal		84,928,954	71,870,157	9,210,531,218	6.58%	414,411,593	24.53%
Received July 24, 2018							
Codeine	9050	17,644,740	14,728,585	5,904,595,163	4.22%	149,048,894	8.82%
Meperidine	9230	6,069,787	4,439,671	296,424,349	0.21%	25,276,542	1.50%
Dihydrocodeine	9120	1,150,066	762,778	47,182,023	0.03%	1,051,401	0.06%
Opium, Powdered	9639	509,879	335,515	8,000,328	0.01%	383,634	0.02%
Subtotal		25,374,472	20,266,549	6,256,201,863	4.47%	175,760,471	10.40%
Received August 28, 2018							
Methadone	9250	15,668,247	14,167,720	6,829,158,005	4.88%	145,228,224	8.59%
Levorphanol	9220	109,502	67,460	14,402,593	0.01%	18,947	0.00%
Subtotal		15,777,749	14,235,180	6,843,560,598	4.89%	145,247,171	8.60%
Total		500,709,803	444,819,182	140,060,758,067	100.00%	1,689,684,984	100.00%

⁶ As explained more fully below I use “Dispensers” to refer to businesses that dispense drugs to patients such as pharmacies and hospitals.

B. ARCOS Data Fields Produced by DEA

31. The ARCOS Data produced by the DEA has the 34 fields illustrated in Figure 1 for each transaction record. Twelve of the 34 fields are submitted with each transaction record by the Reporting Registrant, the DEA registered entity reporting the opioid shipment through ARCOS. These twelve fields are defined in the ARCOS Handbook.⁷ The remaining 22 fields were appended by the DEA to the transaction records submitted by the Reporting Registrant.⁸ Eighteen of the 22 fields are information about the Reporting Registrant and the Associate Registrant, keyed off their DEA numbers.⁹ Three of the remaining four fields are either taken from the NDC (for National Drug Code) Dictionary or are calculated using variables therein and appear to have been imported by the DEA into the data it produced by matching each transaction's NDC number with the NDC number in the NDC Dictionary.¹⁰

Figure 1 ARCOS Data Fields Produced by DEA

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Reporter / Seller Info										Buyer Info										Transaction Info													
DEA #	Name	Business Activity	Address1	Address2	City	State	Zip	Country		DEA #	Name	Business Activity	Address1	Address2	City	State	Zip	Country		Transaction Code	Drug Code	NDC Number	Drug Name	Quantity	Unit	Action Indicator	Order Form Number	Correction Number	Strength	Transaction Date	Calc Base Weight Grams	Dosage Unit	Transaction Id

⁷ “ARCOS Registrant Handbook,” Drug Enforcement Administration, August 1997 (“ARCOS Handbook”). Current version available at www.deadiversion.usdoj.gov/arcos/handbook/full.pdf.

⁸ The 22 fields are Reporter Business Activity, Reporter Name (2 fields), Reporter Address (6 fields), Buyer Business Activity, Buyer Name (2 fields), and Buyer Address (6 fields), Drug Code, Drug Name, Calculated Base Weight in Grams, and Dosage Unit.

⁹ The 18 fields are Reporter Business Activity, Reporter Name (2 fields), Reporter Address (6 fields), Buyer Business Activity, Buyer Name (2 fields), and Buyer Address (6 fields).

32. The first 10 fields provide information on the Reporting Registrant. The DEA identified these Reporter DEA numbers and associated fields as “Seller” fields and so, unless the context requires otherwise, I refer to the Reporting Registrant as the “Seller” and the associated fields as “Seller” fields. This information includes a Seller’s DEA Number, a description of the Seller’s Business Activity (primarily Manufacturer, Distributor or Reverse Distributor), Name and Address (6 fields).

33. The next 10 fields provide information on the Associate Registrant, typically a receiver of the opioid shipment.¹¹ The DEA identified the Associate Registrant DEA numbers and associated fields as “Buyer” fields and so, unless the context requires otherwise, I refer to the Associate Registrant as the “Buyer” and the associated fields as “Buyer” fields. This information includes the Buyer’s DEA Number, a description of the Buyer’s Business Activity (primarily Distributor or Retail or Chain Pharmacy), Name and Address (6 fields).

34. The final 14 fields provide information about the transaction. This information includes Drug Name and Drug Code (e.g. 9143 for oxycodone products), NDC Number, Quantity, Unit, Strength, Dosage Unit, Calculated Base Weight in Grams, Transaction Code (e.g., whether the transaction was a Purchase or a Sale), Transaction Date, Transaction Identifier, Correction Number, Action Indicator, and Order Form Number.

¹⁰ Drug Code and Drug Name are both in the NDC Dictionary. Calculated Base Weight in Grams is calculated using Ingredient Base Weight in the NDC Dictionary and Quantity, Unit, and Strength in the ARCOS Data.

¹¹ See, ARCOS Handbook at pp. 5-36 – 5-37.

1. Seller DEA Number

35. The ARCOS Data produced by the DEA includes 1,506 distinct Seller DEA Numbers. Manufacturers and distributors typically have more than one DEA number as each facility manufacturing or distributing controlled substances must have its own DEA number.¹²

2. Seller Business Activity

36. The ARCOS Data lists one “Business Activity” for each Seller DEA Number. There are six distinct Seller Business Activities in the ARCOS Data: Manufacturer, Manufacturer (Bulk), Chemical Manufacturer, Distributor, Chempack/SNS Distributor, and Reverse Distributor.

3. Seller Name and Address

37. The ARCOS Data provides a business address for each Seller DEA Number, but there is not a one-to-one mapping between the addresses and the Seller DEA Numbers. Some Seller DEA Numbers are associated with multiple addresses, and some addresses are associated with more than one contemporaneous Seller DEA Number. Multiple Seller DEA Numbers can also be associated with the same address over time as locations are occupied by businesses newly registered with the DEA.

4. Buyer DEA Number

38. The ARCOS Data includes 304,785 distinct Buyer DEA Numbers. 1,465 DEA numbers are listed as both Sellers and Buyers, although not in the same transaction.

¹² See, ARCOS Handbook at 1-5.

5. *Buyer Business Activity*

39. The ARCOS Data includes 54 distinct Buyer Business Activities including Manufacturer, Distributor, Reverse Distributor, Analytical Lab, Retail Pharmacy, Chain Pharmacy, Mail Order Pharmacy and Hospital/Clinic. Some Buyer DEA Numbers have more than one Buyer Business Activity.

6. *Buyer Name and Address*

40. The ARCOS Data provides a business address for each Buyer DEA Number, but there is not a one-to-one mapping between the addresses and the Buyer DEA Numbers. Some Buyer DEA Numbers are associated with multiple addresses, and some addresses are associated with more than one contemporaneous Buyer DEA Number. Multiple Buyer DEA Numbers can also be associated with the same address over time as locations are occupied by businesses newly registered with the DEA.

7. *Transaction Codes*

41. Each transaction record includes a code that identifies whether the transaction being reported increases or decreases the Reporter's inventory of the drug. In my later analysis, I focus on transaction code "S" which denotes a transaction in which a drug is shipped from the Seller, typically a distributor, to a Buyer, typically a pharmacy. Appendix 3 reports the percentage of transactions in the ARCOS Data in each Transaction Code and provides the ARCOS Handbook description.¹³

¹³ ARCOS Handbook §5.4.3, p. 5-7.

8. *Drug Code and Drug Name*

42. The Drug Code is a four digit Administration Controlled Substance Code Number common to each controlled substance or basic class thereof.¹⁴ For instance, whether delivered through skin patches or nasal sprays, fentanyl transactions are identified by the Drug Code 9801 and whether formed in 5 mg or 20 mg tablets, oxycodone transactions are identified with the Drug Code 9143. See Table 2.

Table 2 Drug Codes and Drug Names in the ARCOS Data

Sorted by Drug Name		Sorted by Drug Code	
Drug Code	Drug Name	Drug Code	Drug Name
9064	Buprenorphine	9050	Codeine
9050	Codeine	9064	Buprenorphine
9120	Dihydrocodeine	9120	Dihydrocodeine
9801	Fentanyl	9143	Oxycodone
9193	Hydrocodone	9150	Hydromorphone
9150	Hydromorphone	9193	Hydrocodone
9220	Levorphanol	9220	Levorphanol
9230	Meperidine	9230	Meperidine
9250	Methadone	9250	Methadone
9300	Morphine	9300	Morphine
9639	Opium	9639	Opium
9143	Oxycodone	9652	Oxymorphone
9652	Oxymorphone	9780	Tapentadol
9780	Tapentadol	9801	Fentanyl

9. *National Drug Code*

43. Drug packages are uniquely identified in the ARCOS Data by a National Drug Code, or NDC. The NDC has three segments, which identify the drug product's manufacturer or distributor, active ingredient, strength and formulation of the product, and the package size.¹⁵ For example, 00603-3882-

¹⁴ See, Controlled Substances by DEA Drug Code Number, Current version available at https://www.deadiversion.usdoj.gov/schedules/orangebook/d_cs_drugcode.pdf; see also, 21 CFR 1308.03.

¹⁵ "NDC Dictionary Instructions," Drug Enforcement Administration, October 2010. Current version available at <https://www.deadiversion.usdoj.gov/arcos/ndc/readme.txt>.

28 identifies Par Pharmaceutical manufactured 7.5 mg hydrocodone / 500 mg acetaminophen tablets in packages of 30. NDCs ending in “**” identify bulk packages of the drug identified by the first 9 digits of the NDC.

44. There are 23,280 unique NDCs in the ARCOS Data. The controlled substances in each drug product are identified by a separate Drug Code.

10. Quantity

45. Quantity is the number of packages, weight or volume reported in the transaction.¹⁶ A package can take many different forms, including a bottle of pills, a bottle of liquid, a box containing multiple bottles of drug product, a container of bulk drug powder, a box of skin patches, or a larger box containing smaller boxes of skin patches.¹⁷

¹⁶ ARCOS Handbook § 5.11.1 p., 5-30.

¹⁷ ARCOS Handbook § 5.11.

11. Unit

46. The Unit code identifies the unit of measurement for the Quantity field. It is used with the Quantity and Strength fields to determine the amount of drug in a transaction.¹⁸ The Unit codes 1, 2, 3 and 4 specify weight units from micrograms to kilograms.¹⁹ See Table 3.

Table 3 Unit of Measurement Codes

<u>Unit</u>	<u>Measurement</u>
1	Micrograms
2	Milligrams
3	Grams
4	Kilograms
5	Milliliters
6	Liters
D	Dozens
K	Thousands

12. Action Indicator

47. The Action Indicator field is either blank or coded D (for delete), A (for adjust) or I (for insert). The Reporter uses transactions coded D to report to the DEA that a previously reported incorrect transaction should be deleted. The Reporter uses transactions coded A to report that a previously reported incorrect transaction should be revised to reflect updated information in the current record. That is, that the previously reported transaction should be replaced with the current transaction record coded A. The Reporter uses

¹⁸ ARCOS Handbook § 5.12.1, p. 5-33.

¹⁹ Since there are 1 billion micrograms in a kilogram, a transaction coded with a 4 in the Unit field when the Quantity field assumes the Units are micrograms will have a Quantity that is 1 billion times too large. Some of the errors in the ARCOS Data appear to result from incorrect Unit codes being entered by the Reporting Registrant into ARCOS.

transactions coded I to report transactions which should have been reported in a previous month but were not and so are being reported late.²⁰

13. Order Form Number

48. The Order Form Number identifies a batch of one or more transactions submitted through ARCOS.²¹

14. Correction Number

49. The Correction Number identifies a correction transaction which replaces a previously submitted transaction that had been rejected by ARCOS.²²

15. Strength

50. Strength reports the purity of bulk raw material in a transaction, relative to the purity of the NDC, in hundredths of a percentage point. Strength can also refer to the amount by which a quantity of one in the transaction falls short of or exceeds the standard size package of the NDC.²³

16. Transaction Date

51. Transaction Date is the date a shipment occurred, not the date an order was placed by the Buyer or received by the Seller or the date of some other activity.²⁴

17. Calculated Base Weight in Grams

52. The Calculated Base Weight in Grams is the total active ingredient weight, in grams, of a drug in the reported transaction. The

²⁰ ARCOS Handbook §5.9.2, p. 5-20 and §7.5, p. 7-12.

²¹ ARCOS Handbook §5.14.1, p. 5-38 and §5.14.3, p. 5-40.

²² ARCOS Handbook, §5.16, p. 5-42.

²³ ARCOS Handbook, §5.17, p. 5-43.

²⁴ ARCOS Handbook, §5.15.1, p. 5-40.

Calculated Base Weight in Grams in the ARCOS Data produced by the DEA was not reported by the Sellers. Rather, it was calculated by the DEA and appended (along with information about the Buyer and the Seller, the Drug Code, the Drug Name, and the Dosage Units) by the DEA before the data was produced. As explained in Appendix 2, I verify the Calculated Base Weight in Grams for each transaction using the NDC Dictionary.

18. *Dosage Units*

53. Dosage Units is the number of packages in the transaction, multiplied by the number of discrete individual drug products (e.g., pills, patches, lozenges) in each package. Dosage Unit is only populated if the drug product is delivered as a capsule, tablet, film, suppository, patch, lollipop, or lozenge. The Dosage Unit in the ARCOS Data was not reported by the Sellers. Rather, it was calculated by the DEA and appended by the DEA before the data was produced to us. As explained later in this report, I verify Dosage Units for each transaction using the NDC Dictionary.

19. *Transaction ID*

54. The Transaction ID uniquely identifies the transactions submitted by each Seller each month.²⁵ Each Seller restarts the Transaction ID each month at 1. For example, a Seller submitting 33, 41 and 17 transactions over a three-month period would submit transactions numbered 1 to 33 the first month, 1 to 41 the second month and 1 to 17 the third month. A later correction, adjustment or deletion should have the same Transaction ID as the record being corrected, adjusted or deleted. A late transaction uses the next available Transaction ID for the month in which the transaction

²⁵ ARCOS Handbook, §5.18, pp. 5-46 through 5-47.

should have been reported, not a Transaction ID for the month in which the late transaction is being reported.

C. Supplementing the ARCOS Data

55. I added several fields to the ARCOS Data to assist in my analysis. The fields are drug Labeler names from the FDA, drug Labeler company families, Seller company families, drug product potency information from the CDC's Morphine Milligram Equivalents (MME) conversion table, and Buyer business activities from the Centers for Medicare and Medicaid Services.

1. Drug Labeler

56. The ARCOS Data includes the Seller name but not the Labeler name. As explained by the DEA, "A Labeler is any firm that manufacturers, distributes or repacks/relabels a drug product."²⁶ The Labeler is identified in the first segment of the NDC. The FDA, which assigns the Labeler identifier used in the NDC, maintains a public list of Labeler identifiers and their associated companies. I used the FDA's list of drug Labelers to add the names of the drug Labelers to the ARCOS Data.²⁷

57. After adding Labeler names, I manually reviewed the names and grouped them into company families. For example, I assigned "Teva Pharmaceuticals USA, Inc." and "Teva Parenteral Medicines, Inc." to the same "Teva" company family.

²⁶ [NDC Dictionary Instructions](#). See also, ARCOS Handbook, §6.1.2.1, p. 6-2.

²⁷ NDC/NHRIC Labeler Codes," U.S. Food & Drug Administration. Available at www.fda.gov/ForIndustry/DataStandards/StructuredProductLabeling/ucm191017.htm.

2. *MME Conversion Factor*

58. Because each drug can be prescribed in more than one dosage strength (e.g., 5 mg or 10 mg), compiling only the number of pills shipped provides a partial picture of the number of drugs shipped. Also, since different drugs can have different potencies, compiling only the total weight of active ingredient shipped also provides a partial picture of the number of drugs shipped.

59. The CDC has published “MME conversion factors” that allow opioids to be directly comparable to one another by converting different drugs and dosage strengths into morphine milligram equivalents.²⁸ I added the MME conversion factor to the ARCOS Data, matching the NDC in the CDC table to the NDC in the ARCOS Data.

3. *Additional Pharmacy Information*

60. I supplemented the Buyer Business Activity field with data from the Centers for Medicare and Medicaid Services, which assigns National Provider Identifiers (“NPIs”) to most covered health care providers in the United States. In addition to assigning and tracking NPIs, the Centers for Medicare and Medicaid Services provides a classification of Buyers’ Business Activities that is more detailed than the classification in the ARCOS Data, allowing me to better identify mail-order pharmacies, long-term care pharmacies, and managed care pharmacies. I used the Buyer Name and

²⁸ National Center for Injury Prevention and Control. CDC compilation of benzodiazepines, muscle relaxants, stimulants, zolpidem, and opioid analgesics with oral morphine milligram equivalent conversion factors, 2018 version. Atlanta, GA: Centers for Disease Control and Prevention; 2018. Available at www.cdc.gov/drugoverdose/resources/data.html.

Address in the ARCOS Data to look up each Buyer in the NPI database.²⁹ I used the NPI database to identify mail-order, long-term care and managed care pharmacies, but I otherwise relied on the Buyer Business Activity in the ARCOS Data.

D. Exclusions and Corrections to ARCOS Data

61. The ARCOS Data is composed of transactions, or shipments, of opioids between various entities. Table 4 summarizes the number of transactions, the total Dosage Units, and the total Calculated Base Weight in Grams transacted between various types of entities as reflected in the ARCOS Data I received.

²⁹ NPI database.

Table 4 ARCOS Transactions, Grouped by Transaction Participant

	# of Transactions	%	Dosage Units	Dosage Units %	Calculated Base Weight	Calculated Weight %
Shipments to Dispensers						
from Manufacturers	2,762,706	0.55%	1,963,746,971	0.18%	37,570,470	0.00%
from Distributors	422,984,879	84.48%	134,013,039,950	12.07%	1,444,335,948	0.13%
from Reverse Distributors	2,253	0.00%	687,343	0.00%	22,300	0.00%
Total to Dispensers	425,749,838	85.03%	135,977,474,264	12.25%	1,481,928,717	0.13%
Shipments to Distributors						
from Manufacturers	1,550,685	0.31%	291,953,694,524	26.30%	3,179,271,563	0.29%
from Distributors	24,798,146	4.95%	350,052,547,710	31.53%	3,606,767,355	0.33%
from Reverse Distributors	1,327,210	0.27%	107,448,095	0.01%	1,506,287	0.00%
from Dispensers	2,285,969	0.46%	632,110,738	0.06%	6,866,875	0.00%
from Analytical Labs	1,198	0.00%	43,046,052	0.00%	611,594	0.00%
from Other Buyers	40,128	0.01%	1,014,177,881	0.09%	8,865,834	0.00%
Total to Distributors	30,003,336	5.99%	643,803,024,999	57.99%	6,803,889,509	0.62%
Shipments to Manufacturers						
from Manufacturers	151,021	0.03%	97,475,133,509	8.78%	8,778,096,383	0.80%
from Distributors	226,226	0.05%	12,083,288,652	1.09%	94,142,768	0.01%
from Reverse Distributors	110,312	0.02%	2,392,297,817	0.22%	11,910,069	0.00%
from Dispensers	40,899	0.01%	1,875,916,549	0.17%	13,588,120	0.00%
from Analytical Labs	7,807	0.00%	223,368,384	0.02%	2,195,824	0.00%
from Other Buyers	3,045	0.00%	37,359,432	0.00%	66,828,227	0.01%
Total to Manufacturers	539,310	0.11%	114,087,364,343	10.28%	8,966,761,391	0.81%
Shipments to Reverse Distributors						
from Manufacturers	697,001	0.14%	105,770,466,624	9.53%	512,315,637,438	46.56%
from Distributors	1,669,040	0.33%	3,020,403,832	0.27%	42,645,345	0.00%
from Reverse Distributors	5,781,563	1.15%	469,806,226	0.04%	9,848,999	0.00%
from Dispensers	16,738,061	3.34%	1,562,427,349	0.14%	187,184,003	0.02%
from Analytical Labs	64,158	0.01%	127,606,571	0.01%	30,334,732,147	2.76%
from Other Buyers	16,643	0.00%	84,150,318	0.01%	270,182,657	0.02%
Total to Reverse Distributors	24,966,466	4.99%	111,034,860,921	10.00%	543,160,230,589	49.36%
Shipments to Analytical Labs						
from Manufacturers	167,272	0.03%	745,098,504	0.07%	215,457,334	0.02%
from Distributors	14,228	0.00%	115,326,842	0.01%	2,420,568	0.00%
from Reverse Distributors	19,195,712	3.83%	102,987,574,384	9.28%	539,621,113,047	49.04%
Total to Analytical Labs	19,377,212	3.87%	103,847,999,730	9.35%	539,838,990,949	49.06%
Shipments to Other Buyers						
from Manufacturers	20,501	0.00%	658,932,070	0.06%	80,325,531	0.01%
from Distributors	38,625	0.01%	697,580,301	0.06%	10,941,320	0.00%
from Reverse Distributors	8,938	0.00%	1,181,695	0.00%	36,084	0.00%
Total to Other Buyers	68,064	0.01%	1,357,694,066	0.12%	91,302,935	0.01%
Shipments Lost in Transit						
from Manufacturers	106	0.00%	7,191,204	0.00%	94,303	0.00%
from Distributors	4,809	0.00%	89,721,403	0.01%	572,751	0.00%
from Reverse Distributors	662	0.00%	55,064	0.00%	1,071	0.00%
Total Lost in Transit	5,577	0.00%	96,967,670	0.01%	668,125	0.00%
Total	500,709,803	100.00%	1,110,205,385,993	100.00%	1,100,343,772,214	100.00%

62. 85.03% of transactions reported in the ARCOS Data involve shipments to Buyers whose Business Activity suggests they dispense drugs to

patients. I call these Buyers “Dispensers.”³⁰ 3.8% of transactions involve shipments from Dispensers back to manufacturers or distributors.³¹ 5.99% of transactions reported in the ARCOS Data involve shipments to Distributors. The number of transactions from Manufacturers to Distributors is small relative to the number of transactions from Distributors to Distributors, but the Dosage Units and Calculated Based Weight in Grams are similar.

63. Table 4 is not entirely informative of the actual flow of opioids because some transactions reported by Reverse Distributors (“from Manufacturers” and “to Analytical Labs”) have incorrect Dosage Units and Calculated Base Weights in Grams. I do not use these Reverse Distributor transactions in the analysis I present below.

64. Only 0.03% of transactions are shipments to or from importers, exporters, or researchers (“Other Buyers”).³²

65. I removed seven types of transactions from the ARCOS Data before conducting further analysis:

- Obvious duplicate transactions, when the same transaction was reported to ARCOS more than once by the same registrant.

³⁰ I include the following Buyer Business Activities as Dispensers: any Buyer Business Activity beginning with “MLP”; any Buyer Business Activity containing “PHARMACY”, “PRACTITIONER”, “CLINIC”, “MAINT” or “DETOX”; and “AUTOMATED DISPENSING SYSTEM”, “CANINE HANDLER”, and “TEACHING INSTITUTION.”

³¹ I include the following Buyer Business Activities as manufacturers or distributors: any Buyer Business Activity containing “MANUF” or “DISTRIB.”

³² Other Buyers have Buyer Business Activity containing “IMPORT”, “EXPORT”, or “RESEARCHER.”

- Transactions where the Drug Code from the NDC Dictionary is not one of the 14 opioids listed in Table 1.
- Transactions where the Action Indicator code, Correction Number, or both suggest the reported transaction is erroneous.
- Transactions involving reverse distributors, analytical labs, importers, exporters, or researchers.
- Transactions reported by the registrant receiving the shipment when two registrants reported the same transaction, keeping the transaction reported by the registrant sending the shipment.
- Transactions with obvious errors in the reported Quantity.
- Transactions where the Transaction Code is “X” (Lost-in-Transit.)

66. I also corrected the Calculated Base Weight In Grams when it was calculated using an incorrect Ingredient Base Weight from the NDC Dictionary. Appendix 2 provides a detailed explanation of these exclusions and corrections.

E. Comparing ARCOS Data to Retail Drug Summary Reports

67. The DEA publishes six ARCOS Retail Drug Summary Reports (“RDSR”) each year, which summarize the weight of opioids reported in ARCOS transactions by various combinations of Drug Code, Calendar Quarter, Buyer State, Buyer Zip Code, or Buyer’s business activity.³³ The

³³ The six summary reports are updated on an ad hoc basis. The DEA website states that the summary reports are “susceptible to future updates and corrections, without notice, as new information is obtained”

(www.deadiversion.usdoj.gov/arcos/retail_drug_summary/index.html).

least aggregated Retail Drug Summary Report, Report 1, aggregates opioid weight by quadruples of Drug Code, Calendar Quarter, Buyer's State, and the first three digits of the Buyer's Zip Code. As a check on my procedures for correcting the ARCOS Data, I compared the corrected ARCOS Data to ARCOS Retail Drug Summary Report 1.

68. I calculated the total Calculated Base Weight in Grams in the corrected ARCOS Data for each Drug Code, Calendar Quarter, Buyer's State, and three-digit Buyer's Zip Code. I then compared the weights I calculated to the weights reported in ARCOS Retail Drug Summary Report 1.³⁴

69. There are 409,061 Drug Code/Calendar Quarter/State/3-digit zip code quadruples in either the ARCOS Data or the RDSR dataset. 408,389 of these observations are in both datasets, 457 are only in the ARCOS Data and 215 are only in the RDSR data. See Table 5.

70. The 457 observations that are in the ARCOS Data but not in the RDSRs have a total Calculated Base Weight in Grams of 217,068 grams. 216,544 grams (99.8%) of the 217,068 grams are from zip code 851** in Arizona.³⁵ The RDSRs do not report any weights for zip code 851** in 2006 and 2007, even though there are shipments to Buyers in this zip code in 2006 and 2007 in the ARCOS Data and the RDSRs closely match the ARCOS Data for 851** after 2007. Other than the observations, Retail Drug Summary Report 1 is missing for zip code 851** in 2006 and 2007, only 3,231 grams

³⁴ I compared the weights for all quadruples created using all 14 Drug Codes in the ARCOS Data, every calendar quarter from 2006 through 2014, and all 50 states, the District of Columbia, Puerto Rico, American Samoa, and the Virgin Islands.

³⁵ 109 of the 457 transactions are from zip code 851** in Arizona.

are in observations where there is not some data in both the ARCOS Data and RDSRs out of 1.4 billion grams.

Table 5 Comparison Corrected ARCOS Data and RDSR

Drug Code	Drug Code/Quarter/State/ 3-digit Zip Codes in Both Datasets			Drug Code/Quarter/State/ Zip Codes in ARCOS Only		Drug Code/Quarter/State/ Zip Codes in RDSR Only	
	N	Weight of Base Drug (ARCOS)	Weight of Base Drug (RDSR)	N	Weight of Base Drug	N	Weight of Base Drug
9780	21,175	27,832,183	27,836,251	0	0	1	8
9220L	13,821	17,098	16,555	26	64	27	20
9639	30,138	312,322	5,549,118	11	21	34	81
9064	31,923	13,056,340	12,949,923	34	403	5	6
9801	32,116	4,383,862	4,266,080	12	501	12	7
9652	31,287	11,059,802	10,638,657	12	583	13	46
9120	23,214	755,277	746,160	299	590	42	69
9150	32,042	12,838,084	12,899,632	8	930	6	8
9230	32,049	22,785,269	23,105,649	11	4,407	11	147
9050	32,155	140,440,556	149,474,318	8	24,695	13	138
9250B	32,075	133,963,921	134,698,794	8	11,505	9	78
9193	32,164	337,565,862	340,741,300	10	41,620	16	1,342
9300	32,111	195,236,784	195,377,422	10	54,031	13	456
9143	32,119	489,503,746	490,414,951	8	77,718	13	302
Total	408,389	1,389,751,107	1,408,714,811	457	217,068	215	2,707

71. It is possible that both the ARCOS Data and the RDSRs have drug weights, but the weights differ between the ARCOS Data and the RDSRs data. To test this possibility, I calculate the ratio of the weight of each drug, each quarter, each state and 3-digit zip code reported in the RDSRs to the weights I calculated from the transactions in the ARCOS Data for the observations in both the RDSRs and the ARCOS Data. A ratio of 1 (less than 1, more than 1) means the RDSRs summary weights equal (are less than, are more than) the weights I aggregate up to using the ARCOS Data.

72. Table 6 reports the results of this test of the ARCOS Data. 270,300 or 66.2% of the 408,389 Drug Code/Quarter/State/3-digit zip code quadruple observations in both the ARCOS Data and the RDSRs have ratios between 0.995 and 1.005. That is, 2/3rds of the observations have RDSRs reported summary weights within 0.5% of the weights I aggregate up from the

ARCOS Data. 72.4% of the observations have RDSRs reported summary weights within 1.0% of the weights I aggregate up from the processed ARCOS Data.

73. The RDSRs confirm the accuracy of the ARCOS Data I received. The correlation between the RDSRs' reported drug weight and the weights I calculate from the ARCOS Data is **0.999** on a scale from -1.00 to +1.00.

Table 6 Ratios of Retail Drug Summary Report and ARCOS Drug Weights

Drug Code	N	N(%)	1st Percentile	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile	99th Percentile
9050	32,155	7.9%	0.97	1.01	1.04	1.07	1.11	1.20	1.32
9064	31,923	7.8%	0.76	0.92	1.00	1.00	1.00	1.02	1.09
9120	23,214	5.7%	0.00	0.71	1.00	1.00	1.00	1.01	1.19
9143	32,119	7.9%	0.90	0.97	1.00	1.00	1.00	1.02	1.11
9150	32,042	7.8%	0.82	0.97	1.00	1.00	1.00	1.03	1.28
9193	32,164	7.9%	0.89	0.98	1.00	1.00	1.00	1.04	1.35
9220L	13,821	3.4%	0.93	0.93	0.99	1.00	1.00	1.03	1.03
9230	32,049	7.8%	0.89	0.98	1.00	1.00	1.01	1.12	1.37
9250B	32,075	7.9%	0.86	0.99	1.00	1.00	1.00	1.02	1.30
9300	32,111	7.9%	0.88	0.98	1.00	1.00	1.00	1.03	1.17
9639	30,138	7.4%	0.91	1.00	1.00	1.00	1.00	1.00	1.06
9652	31,287	7.7%	0.75	0.94	1.00	1.00	1.00	1.00	1.10
9780	21,175	5.2%	0.93	1.00	1.00	1.00	1.00	1.00	1.07
9801	32,116	7.9%	0.84	0.95	0.98	1.00	1.00	1.06	1.31
Total	408,389	100.0%	0.81	0.96	1.00	1.00	1.00	1.09	1.24

F. Shipments to Dispensers in ARCOS Data

74. Table 7 summarizes the shipments to Dispensers in the ARCOS Data, grouped by the Reporter's Business Activity. Distributors account for 98.6% of Dosage Units, 97.9% of Calculated Base Weight in Grams and 97.9% of MME shipped to Dispensers. Manufacturers account for the remaining 1.4% of Dosage Units, 2.1% of Calculated Base Weight in Grams and 2.1% of MME shipped to Dispensers.

Table 7 Transactions in the ARCOS Data by Reporter's Business Activity

Reporter Business Activity	Transactions	Dosage Units	Dosage Units %	Calculated Base Weight	Calculated Weight %	MME	MME %
Distributor	421,530,926	133,709,314,771	98.56%	1,356,796,167	97.93%	2,680,914,101,690	97.90%
Manufacturer	2,756,345	1,955,460,639	1.44%	28,585,146	2.06%	57,322,460,578	2.09%
Manufacturer (Bulk)	236	0	0.00%	24,138	0.00%	109,124,308	0.00%
Chempack/Sns Distributor	5	3,100	0.00%	12	0.00%	12,108	0.00%
Chemical Manufacturer	13	100	0.00%	1	0.00%	1,535	0.00%
Total	424,287,525	135,664,778,610	100.00%	1,385,405,463	100.00%	2,738,345,700,219	100.00%

75. Table 8 summarizes the same shipments to Dispensers, grouped by Buyer's Business Activity. Chain and retail pharmacies received 90% of Dosage Units and 81.0% of MME.

Table 8 Transactions in the ARCOS Data by Buyer's Business Activity

Buyer Business Activity	Transactions	Dosage Units	Dosage Units %	Calculated Base Weight	Calculated Weight %	MME	MME %
Chain Pharmacy	246,835,945	73,841,015,364	54.43%	666,033,403	48.07%	1,233,630,792,832	45.05%
Retail Pharmacy	140,928,109	48,200,907,883	35.53%	513,472,325	37.06%	984,646,536,364	35.96%
Maint & Detox	470,511	272,879,042	0.20%	54,709,104	3.95%	206,582,513,676	7.54%
Hospital/Clinic	27,089,943	4,436,208,863	3.27%	47,573,140	3.43%	95,244,268,200	3.48%
Hosp/Clinic- VA	2,053,498	3,146,727,943	2.32%	30,723,341	2.22%	55,414,609,438	2.02%
Comp/Maint/Detox	13,065	66,181,228	0.05%	12,379,759	0.89%	47,864,583,656	1.75%
M/O Pharmacy	1,015,020	2,069,141,639	1.53%	22,737,221	1.64%	40,194,291,159	1.47%
Maintenance	34,551	60,050,461	0.04%	9,232,603	0.67%	37,399,070,506	1.37%
Practitioner	4,365,300	688,508,315	0.51%	7,236,333	0.52%	10,913,172,692	0.40%
Pharmacy - Fed	36,783	1,767,041,073	1.30%	11,014,080	0.80%	7,505,762,384	0.27%
Hosp/Clinic- Mil	455,482	565,193,033	0.42%	4,305,632	0.31%	6,315,268,837	0.23%
Practitioner-DW/100	173,678	72,410,532	0.05%	880,747	0.06%	3,189,114,636	0.12%
Hosp/Clinic Fed	252,979	197,622,491	0.15%	1,892,191	0.14%	2,282,977,043	0.08%
Compound/Maint	1,286	2,521,190	0.00%	581,802	0.04%	2,119,819,133	0.08%
Practitioner-DW/30	142,702	81,332,216	0.06%	1,134,336	0.08%	2,024,635,266	0.07%
Central Fill Pharmacy	177,455	158,920,497	0.12%	1,063,229	0.08%	1,432,938,767	0.05%
Practitioner-DW/275	78,406	14,435,929	0.01%	156,535	0.01%	1,041,781,344	0.04%
Other*	162,812	23,680,910	0.02%	279,681	0.02%	543,564,263	0.02%
Total	424,287,525	135,664,778,610	100.00%	1,385,405,463	100.00%	2,738,345,700,196	100.00%

* Each of the following Buyer Business Activities account for 0.01% or less of Dosage Units, Calculated Base Weight, and MME: Automated Dispensing System, Canine Handler, Chain Hosp/Clinic, Compound/Detox, Detoxification, MLP-Ambulance Service, MLP-Animal Shelter, MLP-Dept Of State, MLP-Euthanasia Technician, MLP-Military, MLP-Naturopathic Physician, MLP-Nurse Practitioner, MLP-Nurse Practitioner-DW/100, MLP-Nurse Practitioner-DW/30, MLP-Optometrist, MLP-Physician Assistant, MLP-Physician Assistant-DW/100, MLP-Physician Assistant-DW/30, MLP-Registered Pharmacist, Pharmacy- Mil, Practitioner-Military, and Teaching Institution

76. Table 9 summarizes the shipments to Dispensers reported in the ARCOS Data, by Drug Name sorted by MME. I separate the two treatment drugs - methadone and buprenorphine – from the other twelve opioids. 81.8% of the Dosage Units, 59.6% of the drug weight and 39.0% of the MME are in hydrocodone and oxycodone transactions. Fentanyl’s ranking by MME is much higher than its ranking by Dosage Units and Calculated Base Weight because of fentanyl’s extraordinary potency.

Table 9 Dispenser Transactions in the ARCOS Data, by Drug Name

Drug Name	# of Transactions	Dosage Units	Dosage Units %	Calculated Base Weight	Calculated Weight %	MME	MME %
Oxycodone	102,506,041	39,443,638,048	29.07%	487,790,191	35.21%	731,685,287,239	26.72%
Fentanyl	40,394,370	827,665,591	0.61%	4,254,573	0.31%	429,748,696,115	15.69%
Hydrocodone	169,063,601	71,513,949,560	52.71%	337,444,595	24.36%	337,444,594,688	12.32%
Morphine	36,462,788	6,160,024,567	4.54%	194,904,055	14.07%	194,904,054,774	7.12%
Hydromorphone	13,585,979	2,508,931,874	1.85%	12,802,388	0.92%	51,209,553,177	1.87%
Oxymorphone	4,680,598	603,913,954	0.45%	10,692,502	0.77%	32,077,506,313	1.17%
Codeine	13,524,316	5,542,104,687	4.09%	139,826,868	10.09%	20,974,030,196	0.77%
Tapentadol	2,683,189	341,800,982	0.25%	27,775,137	2.00%	11,110,054,972	0.41%
Meperidine	3,714,651	277,898,650	0.20%	22,431,778	1.62%	2,243,177,782	0.08%
Opium, Powdered	256,128	6,413,324	0.00%	311,913	0.02%	311,912,513	0.01%
Dihydrocodeine	577,799	35,923,889	0.03%	742,597	0.05%	185,649,366	0.01%
Levorphanol	52,699	12,966,499	0.01%	16,690	0.00%	183,588,300	0.01%
Buprenorphine	23,130,178	1,798,413,522	1.33%	12,949,094	0.93%	393,494,906,696	14.37%
Methadone	13,655,188	6,591,133,464	4.86%	133,463,081	9.63%	532,772,688,062	19.46%
Total	424,287,525	135,664,778,610	100.00%	1,385,405,463	100.00%	2,738,345,700,193	100.00%

77. The distribution of shipments to Dispensers reported in the ARCOS Data by the Buyer’s State is presented in Table 10. Dispensers in California received the most Dosage Units, Calculated Base Weight in Grams and MME of any state, followed by Florida, New York, Pennsylvania, Texas and Ohio. These six states account for a little more than 36% of the opioid shipments by Dosage Units, by Calculated Base Weight in Grams and by MME.

78. States at the top of Table 10 are also the most populous states so the last two columns list the states' average annual MME per capita and ranking by average MME per capita over the 2006-2014 period. I have highlighted in bold the top 10 states by average annual MME per capita.

Table 10 Transactions by Buyer's State

Buyer State	Transactions	Dosage Units	%	Calculated Base Weight	%	MME	%	Annual MME per Capita	MME Per Capita Rank
California	34,107,523	14,264,877,314	10.51%	144,141,772	10.40%	246,859,662,243	9.01%	734.8	43
Florida	27,616,312	9,098,788,300	6.71%	118,351,286	8.54%	226,131,172,359	8.26%	1,333.2	9
New York	20,736,077	5,971,126,722	4.40%	73,030,546	5.27%	172,913,317,559	6.31%	990.1	28
Pennsylvania	19,598,249	5,668,364,125	4.18%	64,943,078	4.69%	148,535,796,883	5.42%	1,298.4	13
Texas	27,613,221	8,742,549,516	6.44%	71,862,018	5.19%	129,493,623,313	4.73%	570.0	48
Ohio	17,238,921	5,808,201,206	4.28%	54,544,414	3.94%	111,223,550,718	4.06%	1,071.0	23
Tennessee	13,686,994	5,994,839,784	4.42%	57,452,520	4.15%	102,645,708,753	3.75%	1,794.4	1
Michigan	15,657,498	5,095,961,622	3.76%	50,511,986	3.65%	91,328,166,698	3.34%	1,027.4	25
North Carolina	15,643,049	4,440,262,854	3.27%	42,672,600	3.08%	87,362,097,523	3.19%	1,013.9	26
New Jersey	10,340,566	2,594,019,822	1.91%	36,907,061	2.66%	83,498,893,004	3.05%	1,053.8	24
Georgia	14,455,456	3,801,001,569	2.80%	37,633,248	2.72%	75,382,679,692	2.75%	862.4	36
Massachusetts	7,057,407	2,380,486,973	1.75%	26,494,365	1.91%	71,983,253,204	2.63%	1,218.3	17
Illinois	12,603,063	3,822,345,183	2.82%	34,855,203	2.52%	67,931,037,637	2.48%	587.8	47
Maryland	7,627,291	2,147,291,529	1.58%	28,427,573	2.05%	66,108,923,591	2.41%	1,269.1	14
Washington	10,153,865	3,498,664,035	2.58%	32,579,493	2.35%	65,417,047,015	2.39%	1,078.2	22
Arizona	9,174,585	3,272,911,436	2.41%	37,731,230	2.72%	64,280,967,712	2.35%	1,114.8	19
Indiana	10,764,936	3,519,835,905	2.59%	31,437,427	2.27%	64,095,917,233	2.34%	1,097.3	21
Alabama	9,953,832	2,963,138,041	2.18%	28,986,476	2.09%	57,266,488,315	2.09%	1,329.6	10
Virginia	10,164,590	2,872,357,089	2.12%	27,959,801	2.02%	56,411,115,106	2.06%	781.0	40
Kentucky	8,670,205	2,948,195,082	2.17%	24,362,379	1.76%	52,373,653,760	1.91%	1,338.4	7
Missouri	10,022,961	2,942,676,906	2.17%	28,625,718	2.07%	51,084,012,054	1.87%	946.7	31
Louisiana	7,758,253	2,228,830,859	1.64%	21,961,258	1.59%	46,560,440,305	1.70%	1,138.3	18
Wisconsin	8,453,240	2,277,912,780	1.68%	22,935,948	1.66%	45,616,002,965	1.67%	890.7	34
Oregon	6,499,758	2,456,409,659	1.81%	23,190,588	1.67%	45,158,503,250	1.65%	1,307.7	11
Connecticut	4,678,804	1,220,028,554	0.90%	16,843,975	1.22%	42,070,484,902	1.54%	1,305.7	12
Oklahoma	7,754,529	2,348,879,726	1.73%	23,804,433	1.72%	41,505,731,838	1.52%	1,226.7	16
South Carolina	7,410,978	2,955,452,976	2.18%	25,832,147	1.86%	40,855,047,453	1.49%	979.2	30
Colorado	7,118,929	2,050,362,484	1.51%	19,431,636	1.40%	36,596,005,496	1.34%	805.5	39
Nevada	4,036,934	2,142,415,698	1.58%	20,384,436	1.47%	32,499,779,112	1.19%	1,336.1	8
West Virginia	4,029,210	1,374,956,327	1.01%	12,755,684	0.92%	27,709,710,967	1.01%	1,660.4	3
Utah	4,645,781	1,191,251,574	0.88%	13,027,648	0.94%	27,524,762,408	1.01%	1,102.0	20
Minnesota	5,779,787	1,535,306,160	1.13%	13,894,555	1.00%	27,166,619,673	0.99%	568.4	49
Arkansas	5,716,135	1,570,587,111	1.16%	15,007,344	1.08%	24,094,665,701	0.88%	916.3	33
Mississippi	5,350,915	1,386,433,482	1.02%	12,142,036	0.88%	23,802,388,048	0.87%	890.3	35
Kansas	4,645,815	1,446,407,361	1.07%	12,815,885	0.93%	22,138,468,654	0.81%	860.6	37
Maine	2,287,932	702,819,795	0.52%	7,766,401	0.56%	20,821,157,207	0.76%	1,742.6	2
New Mexico	2,712,555	918,576,860	0.68%	9,349,766	0.67%	17,474,306,450	0.64%	940.4	32
Iowa	4,135,282	993,788,738	0.73%	8,267,520	0.60%	15,030,096,063	0.55%	547.5	50
New Hampshire	2,010,131	510,041,239	0.38%	5,998,471	0.43%	14,809,083,309	0.54%	1,249.7	15
Rhode Island	1,347,663	423,798,510	0.31%	5,161,712	0.37%	13,263,284,979	0.48%	1,399.3	6
Delaware	1,462,493	467,500,163	0.34%	6,167,306	0.45%	12,412,510,274	0.45%	1,532.9	4
Idaho	2,416,554	695,033,682	0.51%	6,185,194	0.45%	11,833,841,803	0.43%	837.0	38
Hawaii	1,267,228	446,181,225	0.33%	5,130,234	0.37%	9,034,404,023	0.33%	736.0	42
Montana	1,928,484	485,756,953	0.36%	4,702,627	0.34%	8,887,494,199	0.32%	997.0	27
Nebraska	2,557,896	546,890,601	0.40%	4,694,388	0.34%	8,468,534,858	0.31%	514.2	51
Vermont	1,021,701	262,435,552	0.19%	2,682,970	0.19%	8,365,763,416	0.31%	1,485.2	5
Alaska	983,292	303,566,486	0.22%	3,093,881	0.22%	6,307,967,858	0.23%	981.6	29
South Dakota	1,111,670	277,567,274	0.20%	2,575,819	0.19%	4,482,577,650	0.16%	610.2	45
District of Columbia	381,866	146,044,088	0.11%	2,061,311	0.15%	3,980,837,130	0.15%	731.1	44
Wyoming	959,479	238,043,423	0.18%	2,128,011	0.15%	3,869,708,563	0.14%	761.8	41
North Dakota	937,630	213,604,257	0.16%	1,902,085	0.14%	3,678,437,269	0.13%	605.9	46
Total	424,287,525	135,664,778,610	100.00%	1,385,405,463	100.00%	2,738,345,700,195	100.00%		

79. The distribution of shipments to Dispensers reported in the ARCOS Data by year is presented in Table 11. The number of transactions, Dosage Units, Calculated Base Weight in Grams and MME all increased between 40% and 50% from 2006 to 2011.

Table 11 Transactions by Year

Year	Transactions	Dosage Units	Dosage Units %	Calculated Base Weight	Calculated Weight %	MME	MME %
2006	39,555,401	11,739,959,163	8.65%	122,589,878	8.85%	227,925,985,286	8.32%
2007	43,199,221	13,043,616,252	9.61%	133,765,032	9.66%	256,132,363,908	9.35%
2008	44,277,708	14,165,192,375	10.44%	143,376,672	10.35%	272,477,604,397	9.95%
2009	45,512,661	15,163,300,848	11.18%	154,476,438	11.15%	298,066,431,931	10.88%
2010	48,012,352	15,970,816,749	11.77%	165,954,825	11.98%	325,444,156,282	11.88%
2011	51,048,709	16,970,668,176	12.51%	173,100,217	12.49%	337,684,741,994	12.33%
2012	51,898,574	16,840,966,759	12.41%	170,970,618	12.34%	342,255,713,841	12.50%
2013	52,092,126	16,097,725,449	11.87%	162,186,996	11.71%	337,531,015,460	12.33%
2014	48,690,773	15,672,532,838	11.55%	158,984,788	11.48%	340,827,687,093	12.45%
Total	424,287,525	135,664,778,610	100.00%	1,385,405,463	100.00%	2,738,345,700,192	100.00%

VI. Opioid Shipment Summary

A. ARCOS Summary on Shipment to Lake County and Trumbull County, OH

80. In this section, we summarize opioid shipment transactions by drug, by reporter's business activity, by buyer's business activity, and by year for Lake County and Trumbull County, OH.

1. Lake County Summary

81. According to the ARCOS Data, between 2006 and 2014, Dispensers in Lake County received 1.6 billion MME of opioids. Given the County's average 229,550 population,³⁶ Dispensers received enough opioids for every resident in the county to consume 794 MME every year from 2006

³⁶ <https://factfinder.census.gov/>

to 2014. Table 12 through Table 15 summarize the End User transactions reported in the ARCOS Data for Lake County.

82. According to the ARCOS Data, between 2006 and 2014, Dispensers in Lake County received 100.8 million Dosage Units of opioids. As shown in Table 12, oxycodone accounted for 46.6% of all Dosage Units and 34.4% of MME in the county. Hydrocodone accounted for 37.3% of all Dosage Units and 9.0% of total MME. Buprenorphine and fentanyl have a large MME relative to their Dosage Units because both are prescribed as skin patches, which deliver the drug for up to one week.

Table 12 Transactions in Lake County by Drug

Drug Name	# of Transactions	Dosage Units	Dosage Units %	MME	MME %
Oxycodone	87,766	47,029,135	46.63%	564,483,814	34.42%
Fentanyl	26,326	660,762	0.66%	298,337,163	18.19%
Hydrocodone	111,005	37,625,304	37.31%	148,278,163	9.04%
Morphine	24,157	3,559,184	3.53%	113,535,577	6.92%
Oxymorphone	4,118	532,460	0.53%	27,465,529	1.67%
Hydromorphone	8,290	1,263,788	1.25%	22,024,647	1.34%
Tapentadol	4,192	607,540	0.60%	18,417,400	1.12%
Codeine	10,430	3,703,501	3.67%	14,139,944	0.86%
Meperidine	2,043	117,075	0.12%	1,175,941	0.07%
Opium, Powdered	310	8,688	0.01%	404,640	0.02%
Dihydrocodeine	512	52,522	0.05%	240,468	0.01%
Levorphanol	8	900	0.00%	11,598	0.00%
Buprenorphine	20,429	1,325,788	1.31%	277,221,398	16.91%
Methadone	11,966	4,362,300	4.33%	154,124,373	9.40%
Total	311,552	100,848,947	100.00%	1,639,860,654	100.00%

83. Table 13 lists all Dispenser transactions in Lake County by reporter business activity.

Table 13 Transactions in Lake County by Reporter's Business Activity

Reporter Business Activity	# of Transactions	Dosage Units	Dosage Units %	MME	MME %
Distributor	311,472	100,789,547	99.94%	1,639,647,737	99.99%
Manufacturer	80	59,400	0.06%	212,918	0.01%
Manufacturer (Bulk)	0	0	0.00%	0	0.00%
Total	311,552	100,848,947	100.00%	1,639,860,654	100.00%

84. Table 14 lists top Dispenser transactions in Lake County by buyer business activity.

Table 14 Transactions in Lake County by Buyer's Business Activity

Buyer Business Activity	# of Transactions	Dosage Units	Dosage Units %	MME	MME %
Chain Pharmacy	261,800	80,739,640	80.06%	1,219,409,507	74.36%
Retail Pharmacy	37,237	18,911,675	18.75%	393,442,422	23.99%
Hospital/Clinic	10,045	1,035,370	1.03%	22,649,825	1.38%
Practitioner	2,261	138,442	0.14%	2,333,577	0.14%
Practitioner-DW/275	58	17,190	0.02%	1,059,188	0.06%
Practitioner-DW/30	140	6,630	0.01%	964,800	0.06%
MLP-Animal Shelter	9	0	0.00%	1,262	0.00%
MLP-Nurse Practitioner	2	0	0.00%	73	0.00%
Canine Handler	0	0	0.00%	0	0.00%
Central Fill Pharmacy	0	0	0.00%	0	0.00%
Comp/Maint/Detox	0	0	0.00%	0	0.00%
Detoxification	0	0	0.00%	0	0.00%
Hosp/Clinic Fed	0	0	0.00%	0	0.00%
Hosp/Clinic- MIL	0	0	0.00%	0	0.00%
Other ¹	0	0	0.00%	0	0.00%
Total	311,552	100,848,947	100.00%	1,639,860,654	100.00%

¹ Other buyer business activities include: Hosp/Clinic-VA, M/O Pharmacy, Maint & Detox, MLP-Ambulance Service, MLP-Nurse Practitioner-DW/30, MLP-Optometrist, MLP-Physician Assistant, Practitioner-DW/100, Teaching Institution.

85. Table 15 lists all Dispenser transactions in Lake County by transaction year.

Table 15 Transactions in Lake County by Year

Transaction Year	# of Transactions	Dosage Units	Dosage Units %	MME	MME %
2006	28,696	7,844,299	7.78%	127,632,231	7.78%
2007	30,714	9,316,014	9.24%	149,033,895	9.09%
2008	33,020	11,006,394	10.91%	173,067,765	10.55%
2009	35,504	12,663,455	12.56%	205,077,537	12.51%
2010	36,541	12,425,613	12.32%	198,759,073	12.12%
2011	38,115	13,197,322	13.09%	209,413,599	12.77%
2012	37,121	12,694,736	12.59%	213,583,814	13.02%
2013	37,423	11,112,709	11.02%	181,616,116	11.08%
2014	34,418	10,588,405	10.50%	181,676,625	11.08%
Total	311,552	100,848,947	100.00%	1,639,860,654	100.00%

86. Table 16 shows the Labelers of oxycodone and hydrocodone shipped by Distributor Defendants to Lake County and Labeler market shares in Dosage Units.

Table 16 Labelers' Market Shares in Distributor Defendants' Oxycodone and Hydrocodone Shipments in Lake County, in Dosage Units, 2006-2014

Labeler Name	Oxycodone	Hydrocodone	Total	DU %
SpecGx LLC	4,417,900	11,398,840	15,816,740	43%
Actavis Pharma, Inc.	5,735,900	6,006,800	11,742,700	32%
Par Pharmaceutical	317,500	5,394,300	5,711,800	16%
Amneal Pharmaceuticals LLC	429,000	911,000	1,340,000	4%
Purdue Pharma LP	399,500	0	399,500	1%
Ethex Corporation	372,600	0	372,600	1%
Teva Pharmaceuticals USA, Inc.	222,300	136,400	358,700	1%
KVK-Tech, Inc.	233,500	0	233,500	1%
Cardinal Health	0	164,160	164,160	0%
AbbVie Inc.	0	161,800	161,800	0%
Sun Pharmaceutical Industries, I	0	108,900	108,900	0%
Zydus Pharmaceuticals (USA) Li	16,100	0	16,100	0%
Endo Pharmaceuticals, Inc.	12,600	0	12,600	0%
Glenmark Pharmaceuticals Inc.,	10,000	0	10,000	0%
Apotex Corp.	7,400	0	7,400	0%
Allergan, Inc.	7,400	0	7,400	0%
Lupin Pharmaceuticals, Inc.	0	3,450	3,450	0%
UCB, Inc.	0	1,000	1,000	0%
Mayne Pharma Inc.	600	0	600	0%
Other Labelers	0	22,200	22,200	0%
Total	12,182,300	24,308,850	36,491,150	100%

87. Table 17 lists the Dispensers that Distributor Defendants shipped oxycodone and hydrocodone to in Lake County.

Table 17 Distributor Defendants' Oxycodone and Hydrocodone Shipments to Dispensers in Lake County, in Dosage Units, 2006-2014

Dispenser Name	Oxycodone	Hydrocodone	Total	DU %
Walgreen Co	7,141,000	6,161,370	13,302,370	36%
CVS	0	7,227,700	7,227,700	20%
Wal-Mart	3,598,700	3,127,000	6,725,700	18%
HBC (Giant Eagle)	0	3,544,400	3,544,400	10%
Rite Aid	0	3,183,520	3,183,520	9%
Chain Pharmacy Total	10,739,700	23,243,990	33,983,690	93%
Retail Pharmacy	0	0	0	0%
Closed Door Pharmacy	1,442,600	1,064,860	2,507,460	7%
Mail Order Pharmacy	0	0	0	0%
Other Dispensers	0	0	0	0%
Grand Total	12,182,300	24,308,850	36,491,150	100%

2. Trumbull County Summary

88. According to the ARCOS Data, between 2006 and 2014, Dispensers in Trumbull County received 2.6 billion MME of opioids. Given the County's average 210,118 population,³⁷ Dispensers received enough opioids for every resident in the county to consume 1,349 MME every year from 2006 to 2014. Table 18 through Table 21 summarize the End User transactions reported in the ARCOS Data for Trumbull County.

³⁷ <https://factfinder.census.gov/>

89. According to the ARCOS Data, between 2006 and 2014, Dispensers in Trumbull County received 131.2 million Dosage Units of opioids. As shown in Table 18, oxycodone accounted for 33.5% of all Dosage Units and 40.0% of MME in the county. Hydrocodone accounted for 55.0% of all Dosage Units and 13.1% of total MME. Buprenorphine and fentanyl have a large MME relative to their Dosage Units because both are prescribed as skin patches, which deliver the drug for up to one week.

Table 18 Transactions in Trumbull County by Drug

Drug Name	# of Transactions	Dosage Units	Dosage Units %	MME	MME %
Oxycodone	110,587	43,997,430	33.54%	1,020,387,683	40.00%
Fentanyl	40,347	673,587	0.51%	361,708,322	14.18%
Hydrocodone	181,647	72,170,908	55.02%	335,047,978	13.13%
Morphine	28,587	3,008,570	2.29%	144,390,346	5.66%
Oxymorphone	4,252	504,700	0.38%	35,073,714	1.37%
Hydromorphone	5,273	651,684	0.50%	22,491,881	0.88%
Codeine	12,882	3,857,442	2.94%	15,574,839	0.61%
Tapentadol	2,723	291,020	0.22%	9,889,800	0.39%
Meperidine	3,429	153,800	0.12%	1,938,488	0.08%
Dihydrocodeine	706	72,932	0.06%	361,008	0.01%
Opium, Powdered	154	4,632	0.00%	196,920	0.01%
Levorphanol	4	400	0.00%	5,160	0.00%
Buprenorphine	20,092	1,452,124	1.11%	324,522,576	12.72%
Methadone	8,341	4,343,800	3.31%	279,278,476	10.95%
Total	419,024	131,183,029	100.00%	2,550,867,192	100.00%

90. Table 19 lists all Dispenser transactions in Trumbull County by reporter business activity.

Table 19 Transactions in Trumbull County by Reporter's Business Activity

Reporter Business Activity	# of Transactions	Dosage Units	Dosage Units %	MME	MME %
Distributor	418,834	131,176,519	100.00%	2,536,225,962	99.43%
Manufacturer	190	6,510	0.00%	14,641,230	0.57%
Manufacturer (Bulk)	0	0	0.00%	0	0.00%
Total	419,024	131,183,029	100.00%	2,550,867,192	100.00%

91. Table 20 lists top Dispenser transactions in Trumbull County by buyer business activity.

Table 20 Transactions in Trumbull County by Buyer's Business Activity

Buyer Business Activity	# of Transactions	Dosage Units	Dosage Units %	MME	MME %
Chain Pharmacy	275,618	86,901,339	66.24%	1,285,653,328	50.40%
Retail Pharmacy	122,352	42,328,662	32.27%	1,223,222,412	47.95%
Hospital/Clinic	19,062	1,908,096	1.45%	40,330,133	1.58%
Practitioner	1,887	43,878	0.03%	1,520,589	0.06%
Practitioner-DW/100	22	578	0.00%	136,859	0.01%
Practitioner-DW/30	52	326	0.00%	2,469	0.00%
Practitioner-DW/275	29	150	0.00%	1,102	0.00%
MLP-Ambulance Service	2	0	0.00%	301	0.00%
Canine Handler	0	0	0.00%	0	0.00%
Central Fill Pharmacy	0	0	0.00%	0	0.00%
Comp/Maint/Detox	0	0	0.00%	0	0.00%
Detoxification	0	0	0.00%	0	0.00%
Hosp/Clinic Fed	0	0	0.00%	0	0.00%
Hosp/Clinic- MIL	0	0	0.00%	0	0.00%
Other ¹	0	0	0.00%	0	0.00%
Total	419,024	131,183,029	100.00%	2,550,867,192	100.00%

¹ Other buyer business activities include: Hosp/Clinic-VA, M/O Pharmacy, Maint & Detox, MLP-Animal Shelter, MLP-Nurse Practitioner, MLP-Nurse Practitioner-DW/30, MLP-Optometrist, MLP-Physician Assistant, Teaching Institution.

92. Table 21 lists all Dispenser transactions in Trumbull County by transaction year.

Table 21 Transactions in Trumbull County by Year

Transaction Year	# of Transactions	Dosage Units	Dosage Units %	MME	MME %
2006	38,839	10,982,317	8.37%	245,674,285	9.63%
2007	40,584	12,405,078	9.46%	307,006,434	12.04%
2008	44,295	14,196,180	10.82%	270,891,240	10.62%
2009	46,047	15,063,106	11.48%	270,820,031	10.62%
2010	50,446	15,808,735	12.05%	298,643,570	11.71%
2011	50,015	16,299,462	12.42%	299,296,897	11.73%
2012	50,604	15,901,895	12.12%	289,416,805	11.35%
2013	51,531	15,111,414	11.52%	280,260,435	10.99%
2014	46,663	15,414,842	11.75%	288,857,494	11.32%
Total	419,024	131,183,029	100.00%	2,550,867,192	100.00%

93. Table 22 shows the Labelers of oxycodone and hydrocodone shipped by Distributor Defendants to Trumbull County and Labeler market shares in Dosage Units.

Table 22 Labelers' Market Shares in Distributor Defendants' Oxycodone and Hydrocodone Shipments in Trumbull County, in Dosage Units, 2006-2014

Labeler Name	Oxycodone	Hydrocodone	Total	DU %
SpecGx LLC	1,045,400	16,668,240	17,713,640	39%
Par Pharmaceutical	104,700	12,822,100	12,926,800	28%
Actavis Pharma, Inc.	3,253,700	9,027,000	12,280,700	27%
Amneal Pharmaceuticals LLC	87,000	895,900	982,900	2%
AbbVie Inc.	0	616,200	616,200	1%
Purdue Pharma LP	348,000	0	348,000	1%
Teva Pharmaceuticals USA, Inc.	62,000	179,700	241,700	1%
Sun Pharmaceutical Industries, I	0	160,900	160,900	0%
Ethex Corporation	118,700	0	118,700	0%
KVK-Tech, Inc.	100,500	0	100,500	0%
UCB, Inc.	0	20,700	20,700	0%
Apotex Corp.	19,500	0	19,500	0%
Brighton Pharmaceuticals, Inc.	0	11,400	11,400	0%
Glenmark Pharmaceuticals Inc.,	9,100	0	9,100	0%
Endo Pharmaceuticals, Inc.	5,700	0	5,700	0%
Lupin Pharmaceuticals, Inc.	0	2,430	2,430	0%
Zydus Pharmaceuticals (USA) Ii	2,400	0	2,400	0%
Allergan, Inc.	800	0	800	0%
Forest Laboratories, Inc.	0	600	600	0%
Mayne Pharma Inc.	400	0	400	0%
Other Labelers	0	0	0	0%
Total	5,157,900	40,405,170	45,563,070	100%

94. Table 23 lists the Dispensers that Distributor Defendants shipped oxycodone and hydrocodone to in Trumbull County.

Table 23 Distributor Defendants' Oxycodone and Hydrocodone Shipments to Dispensers in Trumbull County, in Dosage Units, 2006-2014

Dispenser Name	Oxycodone	Hydrocodone	Total	DU %
Rite Aid	0	14,118,240	14,118,240	31%
Walgreen Co	4,021,900	8,456,930	12,478,830	27%
HBC (Giant Eagle)	0	7,443,700	7,443,700	16%
CVS	0	7,410,200	7,410,200	16%
Wal-Mart	1,136,000	2,976,100	4,112,100	9%
Chain Pharmacy Total	5,157,900	40,405,170	45,563,070	100%
Retail Pharmacy	0	0	0	0%
Closed Door Pharmacy	0	0	0	0%
Mail Order Pharmacy	0	0	0	0%
Other Dispensers	0	0	0	0%
Grand Total	5,157,900	40,405,170	45,563,070	100%

B. Defendants' Shipment Summary

95. In addition to receiving the ARCOS Data produced by the DEA, I received Transactional Data produced in discovery by five Defendants, CVS, HBC Service Company, Rite Aid, Walgreens and Wal-Mart. I analyzed the Defendants' Transactional Data and found that there are small gaps in the data produced by Defendants. I compared transactions in each Defendant's Transactional Data to the ARCOS Data. I matched the transactions based on NDC, Buyer's DEA Number, Quantity, and Transaction Date (within ± 5 days). After matching the transactions, I converted the transaction Quantity to both Dosage Units and MME.

96. Table 24 presents summary statistics comparing the ARCOS Data and the Defendants' Transactional Data. The transactions summarized in Table 24 consist of all transactions by those Defendants in Lake County and Trumbull County, OH, involving the 14 opioids in Table 12. Other than CVS, the comparison was summarized from January 1, 2006 through December 31, 2014.³⁸

Table 24 Overlap between ARCOS Data and Defendant Data

Defendant	Transactions in Both Datasets		Transactions Only in ARCOS				Transactions Only in Defendants			
	Dosage Unit	MME	Dosage Unit	%	MME	%	Dosage Unit	%	MME	%
CVS	13,297,400	57,468,261	17,600	0.13%	78,323	0.14%	3,300	0.02%	14,313	0.02%
HBC	10,894,230	46,170,729	0	0.00%	0	0.00%	138,220	1.27%	569,134	1.23%
Rite Aid	17,198,020	76,451,962	0	0.00%	0	0.00%	159,300	0.93%	686,912	0.90%
Walgreens	28,798,300	402,062,968	0	0.00%	0	0.00%	151,145	0.52%	4,204,104	1.05%
Wal-Mart	8,750,070	89,666,415	0	0.00%	0	0.00%	438,840	5.02%	7,204,897	8.04%
Total	78,938,020	671,820,335	17,600	0.02%	78,323	0.01%	890,805	1.13%	12,679,360	1.89%

97. Using my matching criteria, over 98.1% of all MME or Dosage Units in either the ARCOS Data or the datasets produced by Defendants are in both the ARCOS Data and the datasets produced by Defendants (*i.e.*, the MME and Dosage Units are in the intersection of the ARCOS Data and the datasets produced by Defendants).

98. The 98.1% overlap between the ARCOS Data and the datasets produced by Defendants demonstrates that the ARCOS Data and the datasets produced by Defendants in discovery are both reliable. The remainder of this section explains the slight differences between the ARCOS Data and the

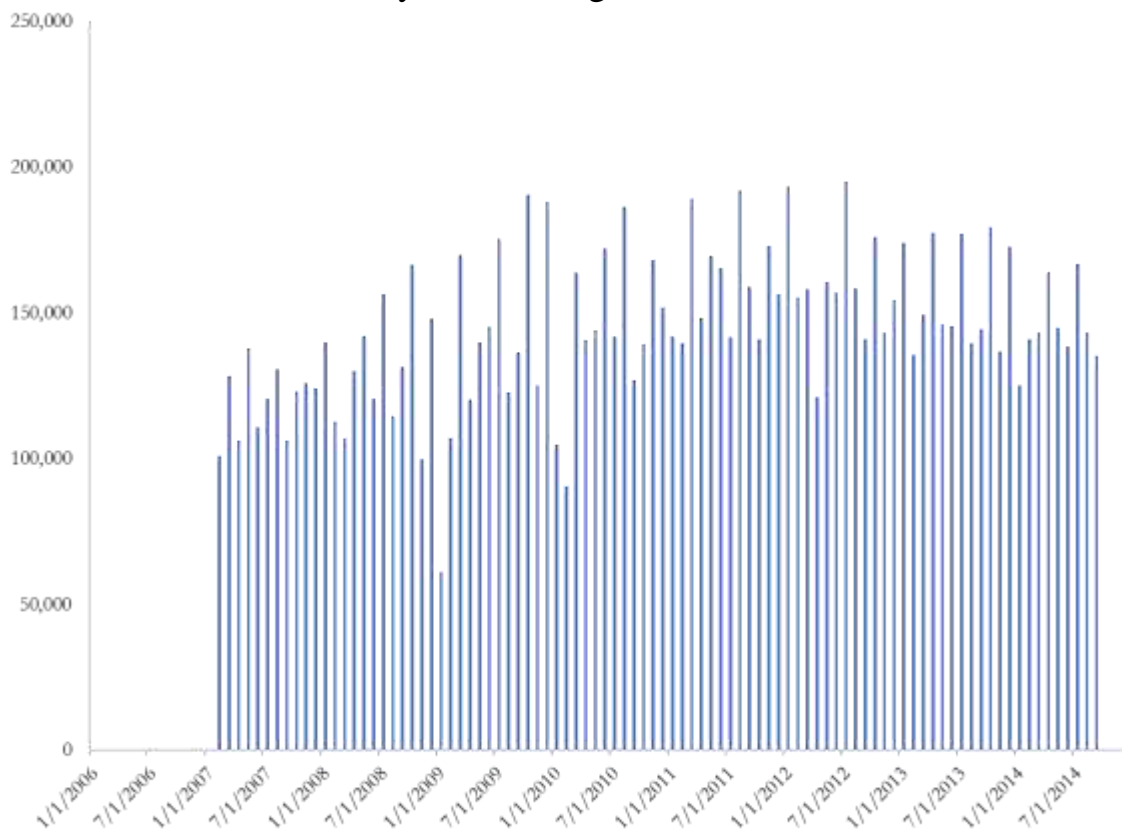
³⁸ The CVS' Transactional Data ("CVS-MDLT3-000009932") include transactions from 2002 to 2014. The data we received identifies the buyer as a Customer Number, instead of the DEA Number. We cannot match this Customer Number with a DEA Number for some transactions before February 2007. For comparison, we filter the CVS' Transactional Data to the period from February 2007 to December 2014.

Defendants' data. I fill in those transactions that are shown in Defendants' Transactional Data but not in ARCOS before I produce the Exhibits.

1. CVS

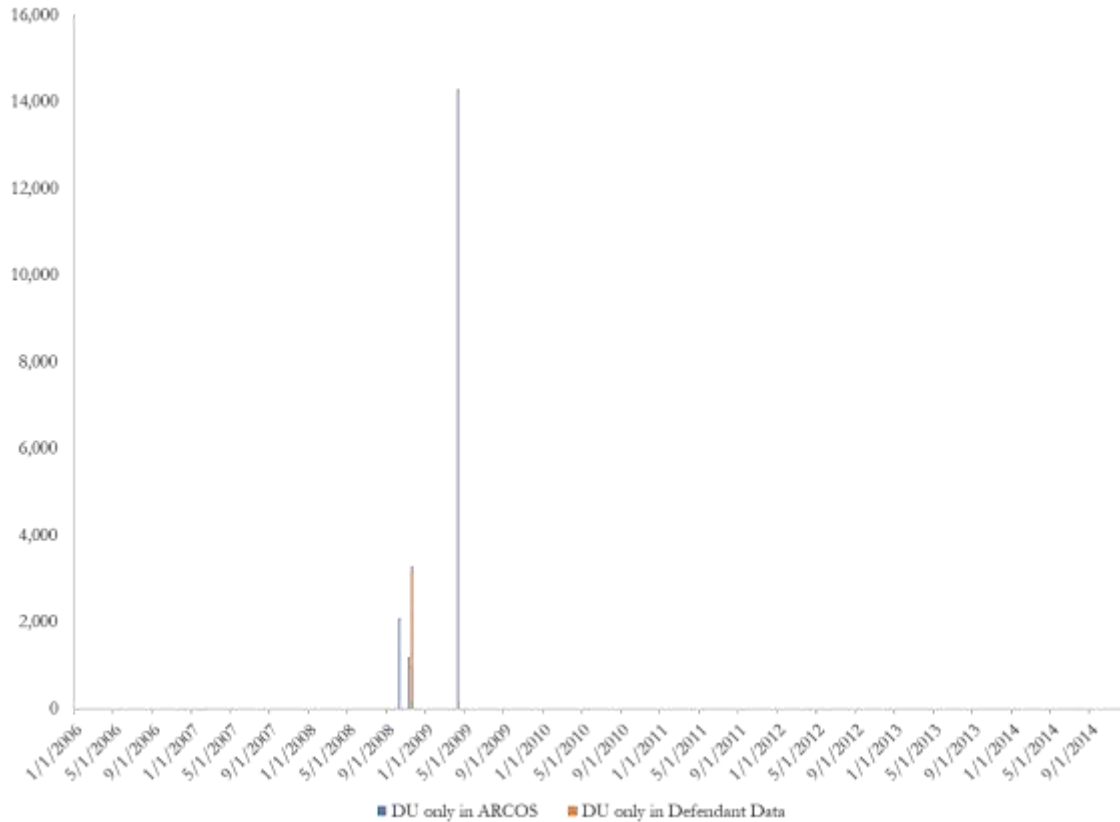
99. Figure 2 shows the matched Dosage Units reported each month in the ARCOS Data and in CVS' Transactional Data in Lake County and Trumbull County, OH.

Figure 2 Dosage Units Reported Both in the ARCOS Data and CVS' Transactional Data, January 2006 through December 2014



100. Figure 3 shows the Dosage Units reported only in the ARCOS Data and only in the CVS' Transactional Data in Lake County and Trumbull County, OH. ARCOS Data miss CVS transactions in May 2009 which were shown in the CVS's Transactional Data.

Figure 3 Dosage Units Reported only in the ARCOS Data and only in the CVS' Transactional Data, January 2006 through December 2014



101. Table 25 summarizes the results of matching ARCOS Data and CVS' Transactional Data. 99.9% of the Dosage Units and MME reported in transactions in either the ARCOS Data or CVS' Transactional Data are reported in both the ARCOS Data and CVS' Transactional Data.

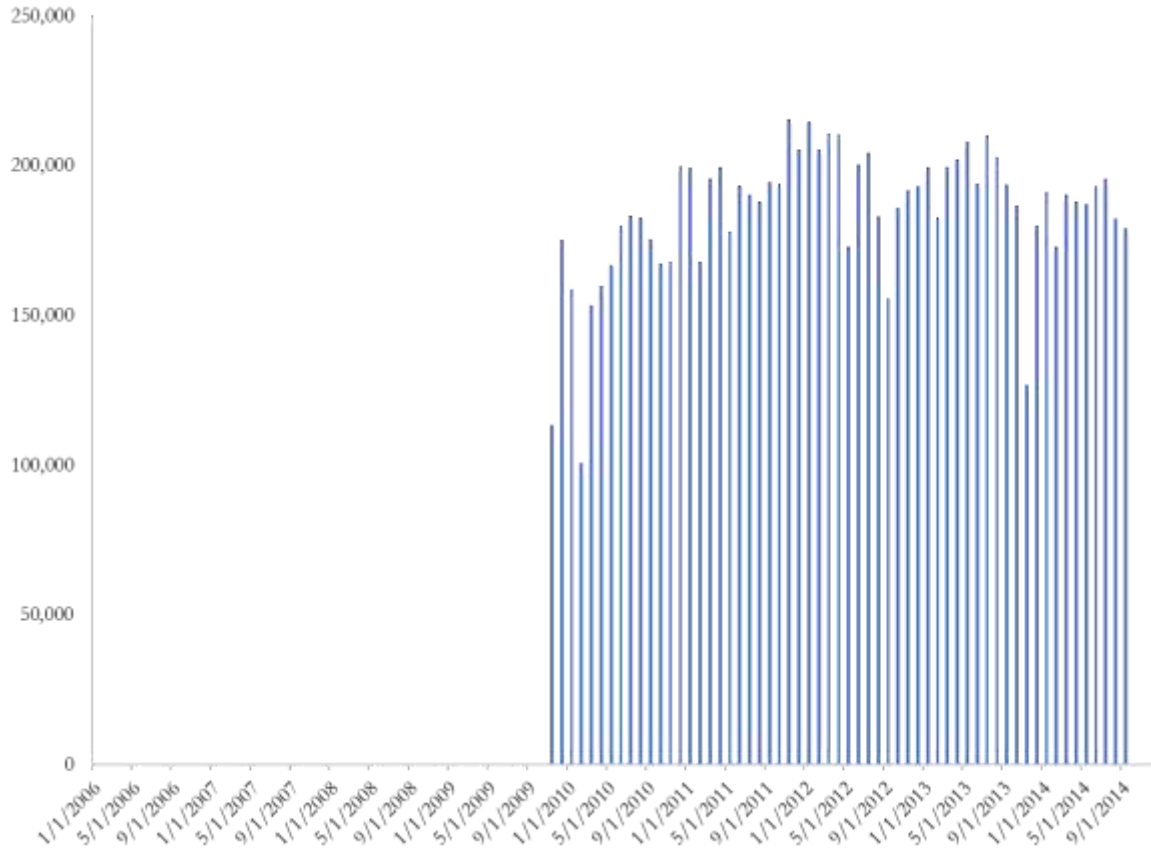
Table 25 Comparison by Drug code in ARCOS Data vs. CVS' Transactional Data

Base Drug	Matched DU		Matched MME		Only in ARCOS			Only in Defendant Data			
	DU		MME	DU	%	MME	%	DU	%	MME	%
9050	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9064	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9120	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9143	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9150	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9193	13,297,400		57,468,261	17,600	0.13%	78,323	0.14%	3,300	0.02%	14,313	0.02%
9220	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9230	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9250	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9300	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9639	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9652	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9780	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9801	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Total	13,297,400		57,468,261	17,600	0.13%	78,323	0.14%	3,300	0.02%	14,313	0.02%

2. *HBC Service Company*

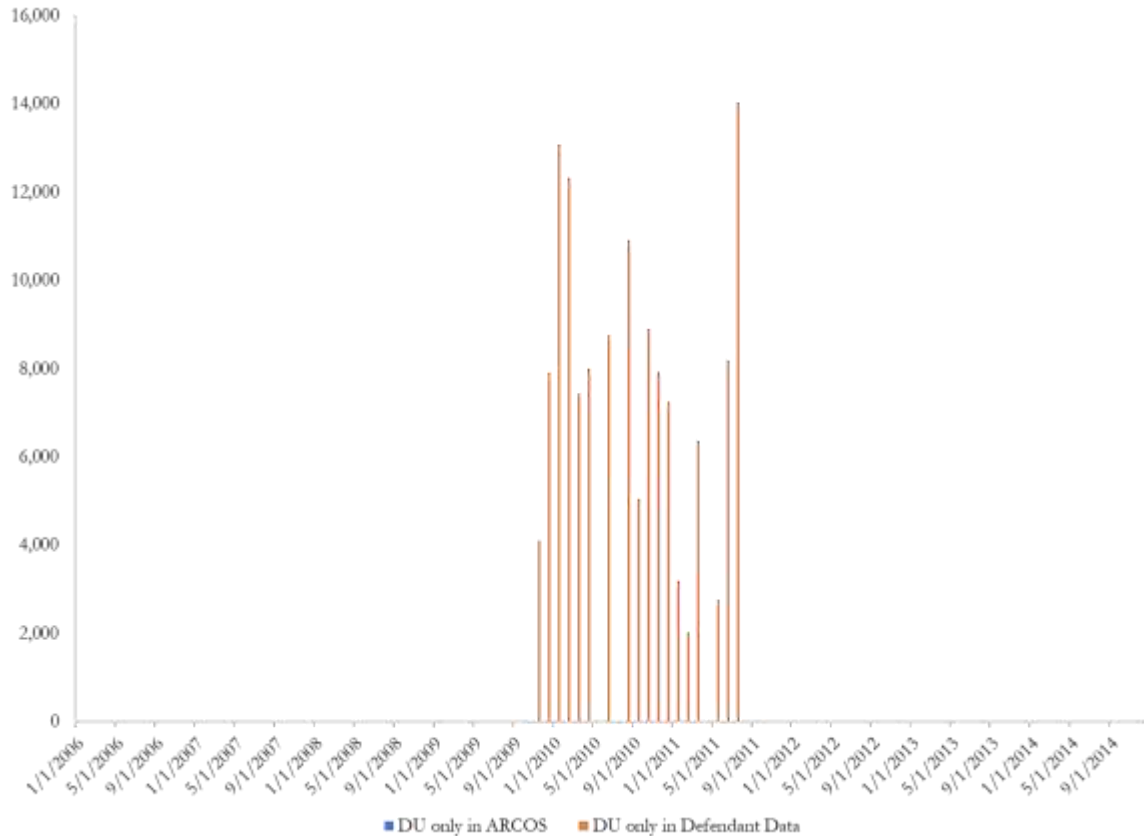
102. Figure 4 shows the matched Dosage Units reported each month in the ARCOS Data and in HBC's Transactional Data in Lake County and Trumbull County, OH.

Figure 4 Dosage Units Reported in the ARCOS Data and HBC's Transactional Data, January 2006 through December 2014



103. Figure 5 shows the Dosage Units reported only in the ARCOS Data and only in the HBC's Transactional Data in Lake County and Trumbull County, OH. Other than in a few months between December 2009 and July 2011, the HBC's Transactional Data and the ARCOS match perfectly.

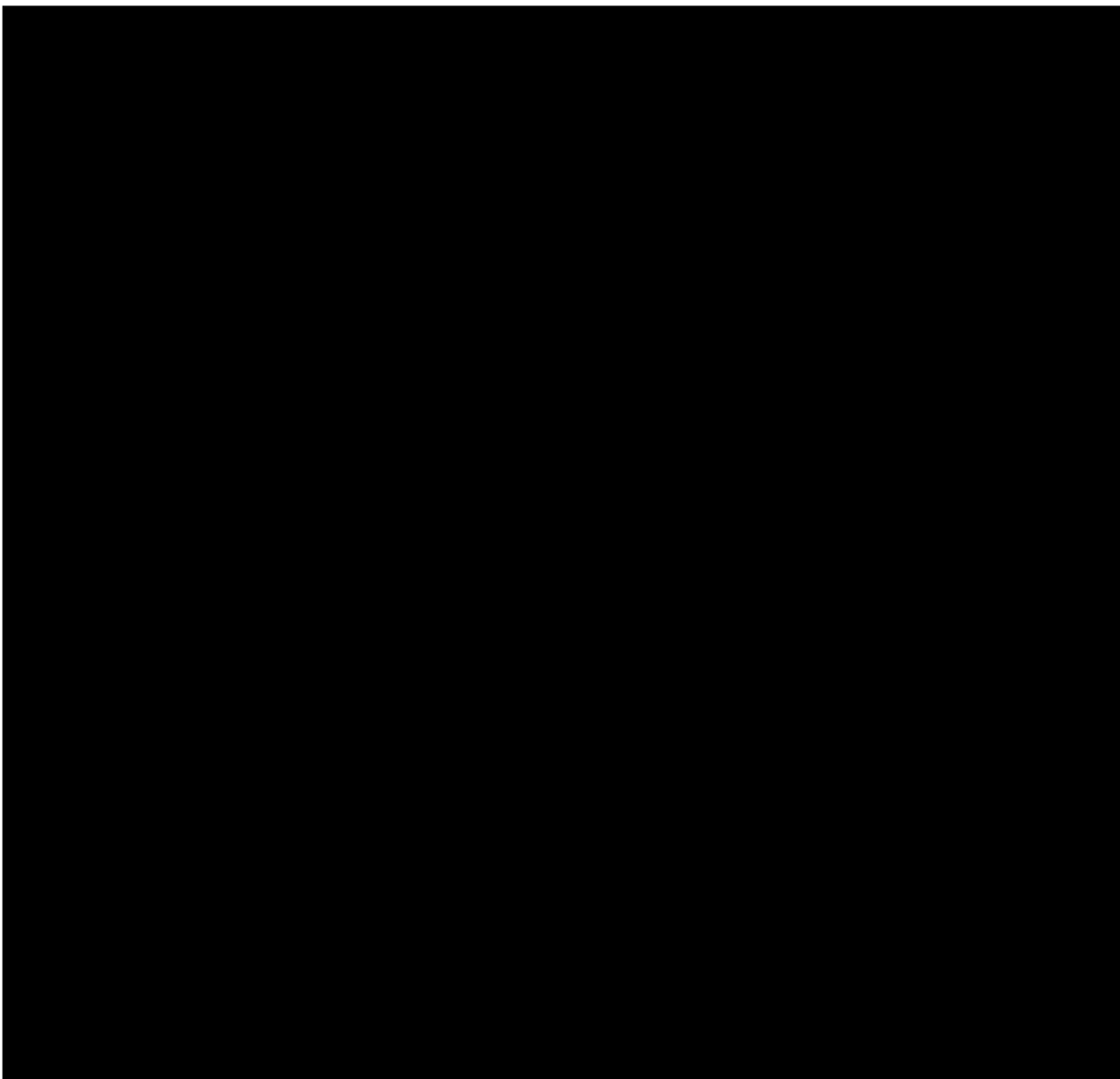
Figure 5 Dosage Units Reported only in the ARCOS Data and only in the HBC's Transactional Data, January 2006 through December 2014

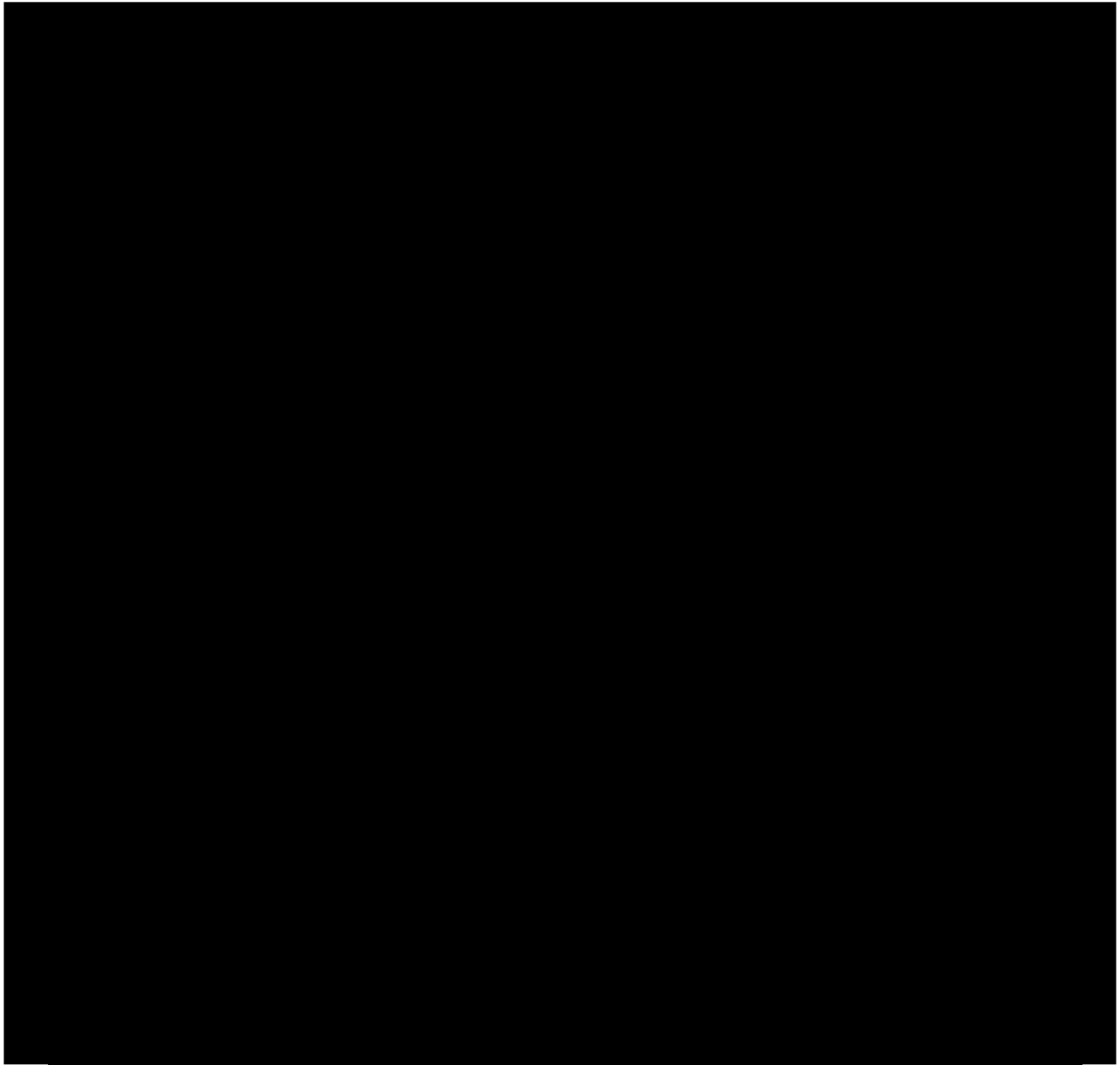


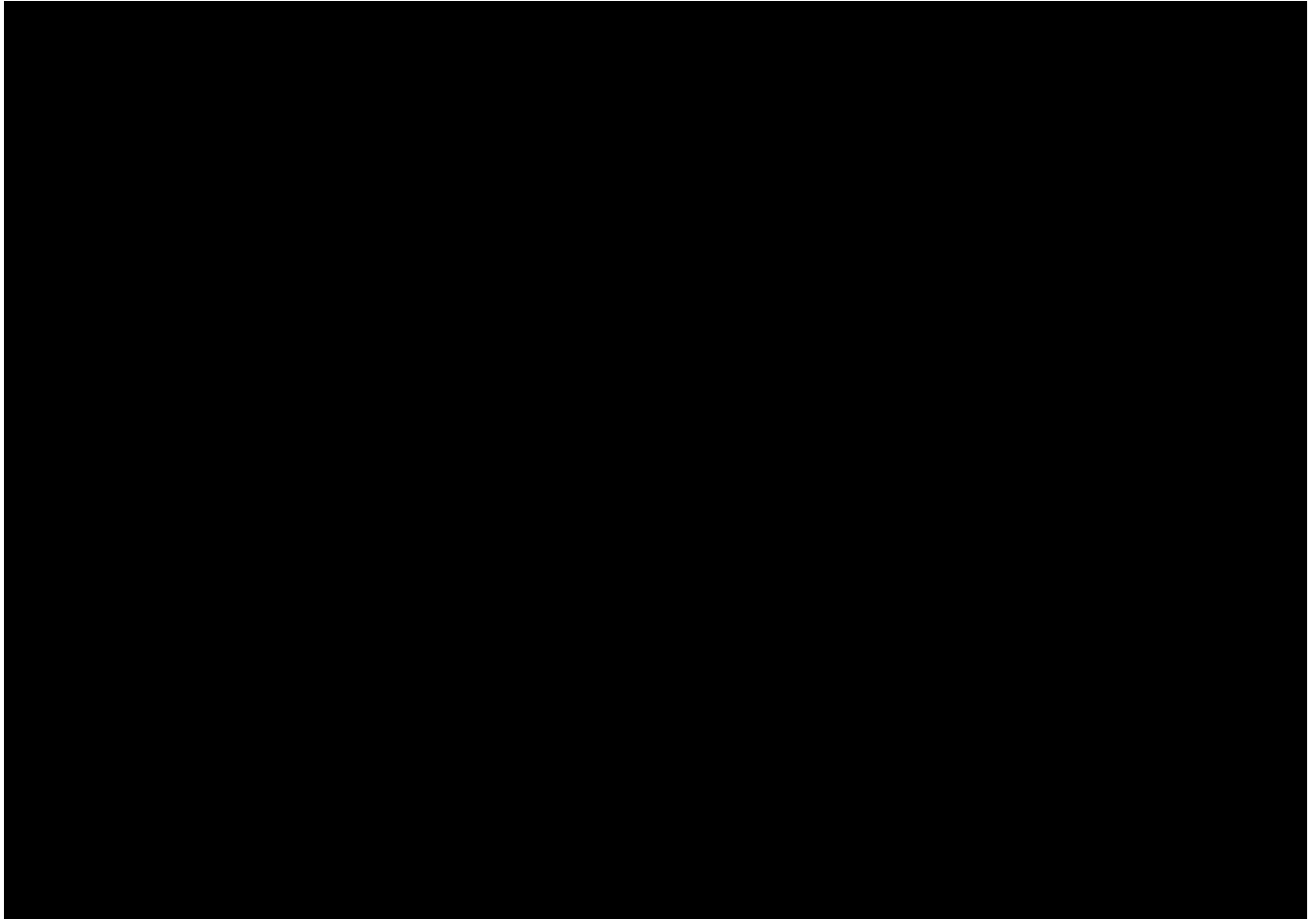
104. Table 26 summarizes the results of matching ARCOS Data and HBC's Transactional Data. 98.7% of the Dosage Units and 98.8% of the MME reported in transactions in either the ARCOS Data or HBC's Transactional Data are reported in both the ARCOS Data and HBC's Transactional Data.

Table 26 Comparison by Drug code in ARCOS Data vs. HBC's Transactional Data

Base Drug	Matched DU		Matched MME		Only in ARCOS			Only in Defendant Data			
	DU		MME	DU	%	MME	%	DU	%	MME	%
9050	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9064	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9120	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9143	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9150	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9193	10,894,230		46,170,729	0	0.00%	0	0.00%	138,220	1.27%	569,134	1.23%
9220	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9230	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9250	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9300	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9639	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9652	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9780	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9801	0		0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Total	10,894,230		46,170,729	0	0.00%	0	0.00%	138,220	1.27%	569,134	1.23%



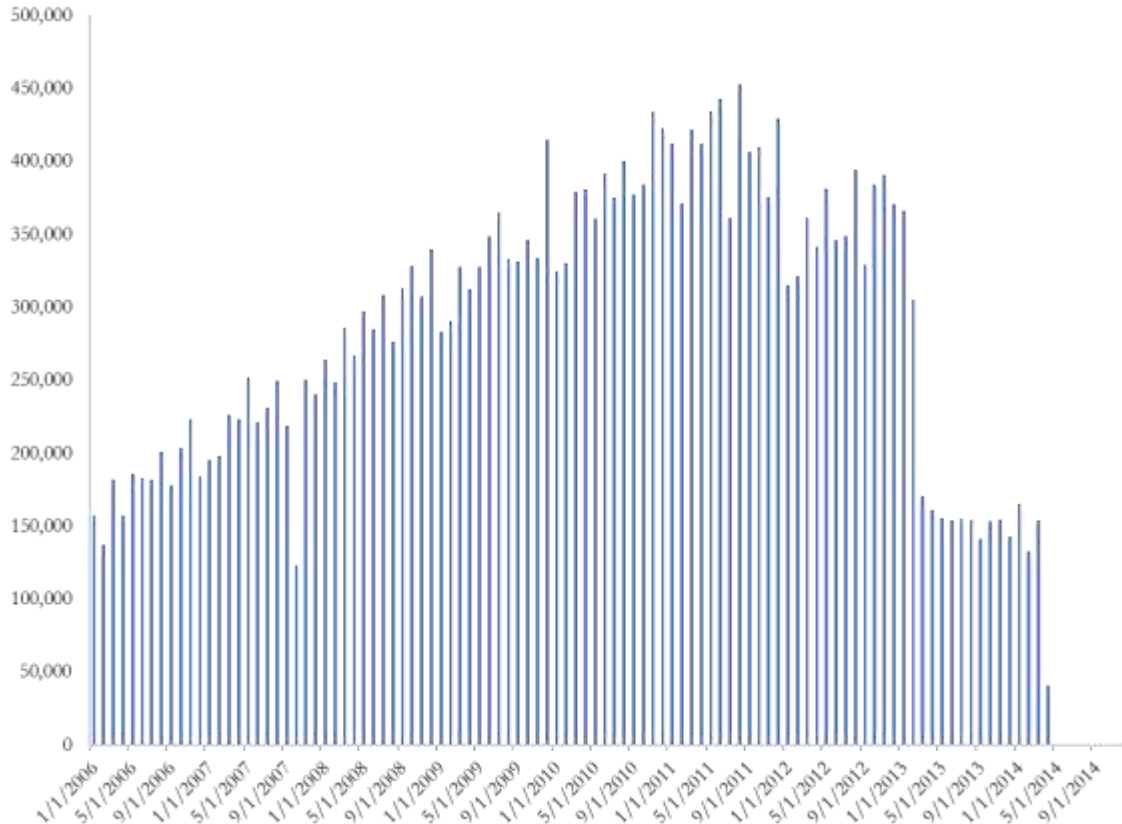




4. Walgreens

108. Figure 8 shows the matched Dosage Units reported each month in the ARCOS Data and in Walgreens' Transactional Data in Lake County and Trumbull County, OH.

Figure 8 Dosage Units Reported in the ARCOS Data and Walgreens' Transactional Data, January 2006 through December 2014



109. Figure 9 shows the Dosage Units reported only in the ARCOS Data and only in the Walgreens' Transactional Data in Lake County and Trumbull County, OH. Other than the months of October 2007 and May 2013 when there were no Walgreens shipment in ARCOS, the two data sets match perfectly.

Figure 9 Dosage Units Reported only in the ARCOS Data and only in the Walgreens' Transactional Data, January 2006 through December 2014



110. Table 28 summarizes the results of matching ARCOS Data and Walgreens' Transactional Data. 99.5% of the Dosage Units and 99.0% of the MME reported in transactions in either the ARCOS Data or Walgreens' Transactional Data are reported in both the ARCOS Data and Walgreens' Transactional Data.

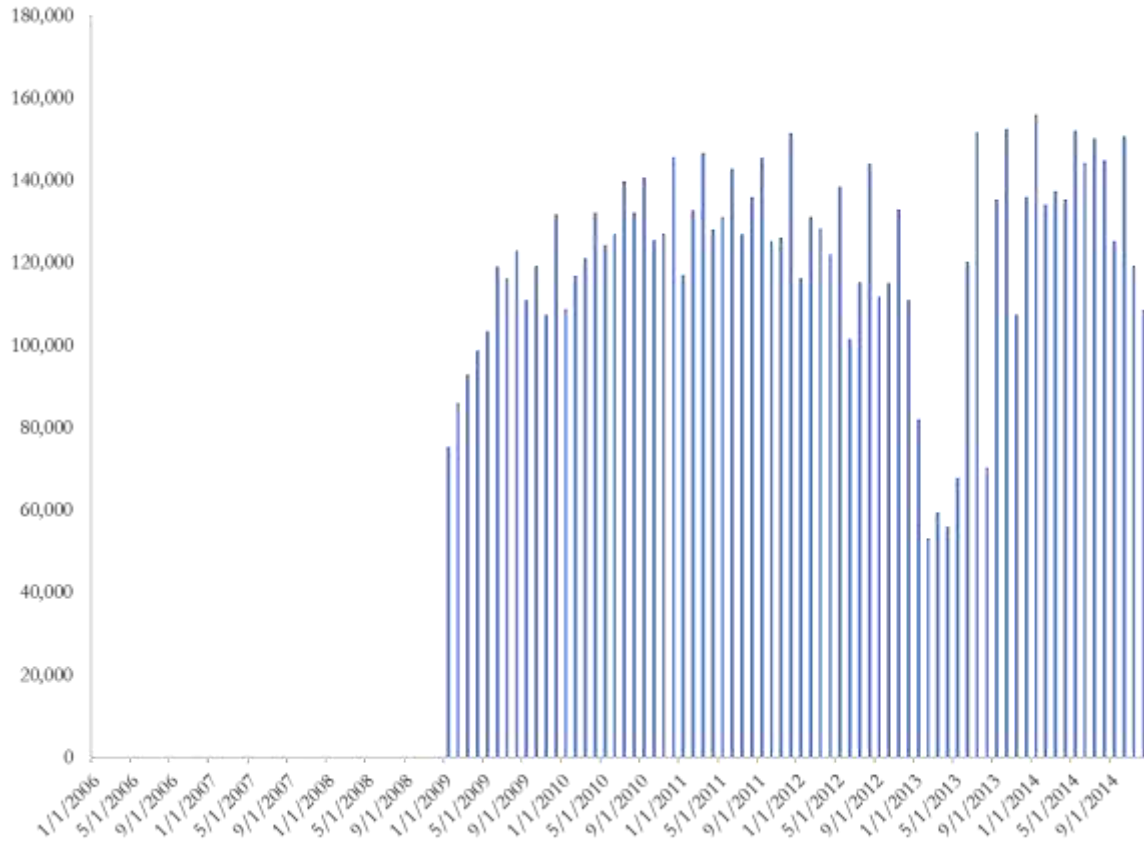
Table 28 Comparison by Drug code in ARCOS Data vs. Walgreens' Transactional Data

Base Drug	Matched DU	Matched MME	Only in ARCOS			Only in Defendant Data				
	DU	MME	DU	%	MME	%	DU	%	MME	%
9050	0	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9064	0	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9120	0	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9143	11,162,900	181,053,074	0	0.00%	0	0.00%	95,500	0.86%	1,500,214	0.83%
9150	281,200	3,801,741	0	0.00%	0	0.00%	3,800	1.35%	42,557	1.12%
9193	14,610,480	63,792,768	0	0.00%	0	0.00%	20,820	0.14%	88,009	0.14%
9220	0	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9230	0	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9250	1,539,800	60,334,435	0	0.00%	0	0.00%	15,500	1.01%	1,150,198	1.91%
9300	1,021,100	32,367,084	0	0.00%	0	0.00%	13,800	1.35%	511,451	1.58%
9639	0	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9652	19,900	520,540	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9780	52,700	1,054,000	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9801	110,220	59,139,325	0	0.00%	0	0.00%	1,725	1.57%	911,675	1.54%
Total	28,798,300	402,062,968	0	0.00%	0	0.00%	151,145	0.52%	4,204,104	1.05%

5. *Wal-Mart*

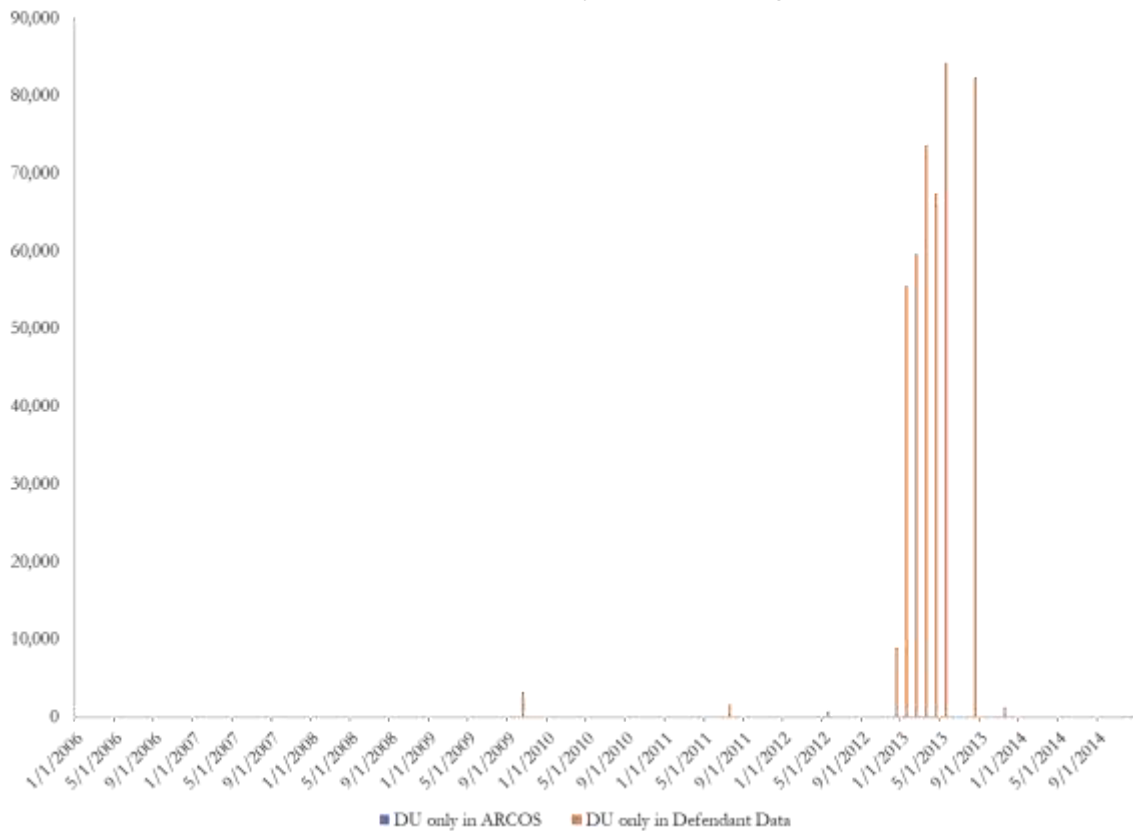
111. Figure 10 shows the matched Dosage Units reported each month in the ARCOS Data and in Wal-Mart's Transactional Data in Lake County and Trumbull County, OH.

Figure 10 Dosage Units Reported in the ARCOS Data and Wal-Mart's Transactional Data, January 2006 through December 2014



112. Figure 11 shows the Dosage Units reported only in the ARCOS Data and only in the Wal-Mart's Transactional Data in Lake County and Trumbull County, OH. Other than some missing shipment from ARCOS in a few months between December 2012 and August 2013, the two data sets match perfectly.

Figure 11 Dosage Units Reported only in the ARCOS Data and only in the Wal-Mart's Transactional Data, January 2006 through December 2014



113. Table 29 summarizes the results of matching ARCOS Data and Wal-Mart's Transactional Data. 95.2% of the Dosage Units and 92.6% of the MME reported in transactions in either the ARCOS Data or Wal-Mart's Transactional Data are reported in both the ARCOS Data and Wal-Mart's Transactional Data.

Table 29 Comparison by Drug code in ARCOS Data vs. Wal-Mart's Transactional Data

Base Drug	Matched DU	Matched MME	Only in ARCOS				Only in Defendant Data			
	DU	MME	DU	%	MME	%	DU	%	MME	%
9050	0	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9064	0	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9120	0	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9143	3,671,200	41,985,024	0	0.00%	0	0.00%	376,400	10.25%	4,438,325	10.57%
9150	70,900	906,460	0	0.00%	0	0.00%	6,100	8.60%	80,149	8.84%
9193	4,513,800	18,981,715	0	0.00%	0	0.00%	6,500	0.14%	39,343	0.21%
9220	0	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9230	0	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9250	280,600	9,711,395	0	0.00%	0	0.00%	32,000	11.40%	1,106,820	11.40%
9300	174,600	5,049,530	0	0.00%	0	0.00%	15,800	9.05%	460,600	9.12%
9639	0	0	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9652	7,200	270,306	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9780	7,300	146,000	0	0.00%	0	0.00%	0	0.00%	0	0.00%
9801	24,470	12,615,985	0	0.00%	0	0.00%	2,040	8.34%	1,079,660	8.56%
Total	8,750,070	89,666,415	0	0.00%	0	0.00%	438,840	5.02%	7,204,897	8.04%

VII. Lake County and Trumbull County, OH Opioid Distributor Summary

114. I have been asked by Counsel to implement various approaches to identify transactions meeting specified criteria using the ARCOS Data from 2006 to 2014. I calculated the results separately for each of twelve controlled substance drug codes.³⁹ Additional charts and tables reflecting the result of applying the methodologies below to each Distributor are in Appendix 8A.

³⁹ I do not analyze transactions in two treatment drugs: buprenorphine and methadone.

A. Method 1: Maximum Monthly, Trailing Six-month Threshold

115. Under the first approach, I identify transactions that cause the number of Dosage Units shipped by a Distributor Defendant to a pharmacy in a calendar month to exceed the highest number of Dosage Units shipped by the Distributor Defendant to the pharmacy in any one of the six preceding calendar months. For example, if the number of Dosage Units containing hydrocodone shipped from a Distributor Defendant to a pharmacy in February, March, April, May, June, and July was 5,000; 10,000; 7,000; 8,000; 9,000; and 9,500 respectively, a requested transaction in August would be flagged if it would cause the number of Dosage Units containing hydrocodone the Distributor Defendant shipped to the pharmacy to exceed 10,000. Any reported transactions containing hydrocodone on that date and all reported transactions containing hydrocodone from that Distributor Defendant to that pharmacy thereafter are flagged.

116. In this approach and the others implemented below (except Method 2), I have been asked by Counsel to assume that the Distributor did not effectively investigate the flagged transactions and so every subsequent transaction of that drug code is also flagged because the Distributor had an unfulfilled obligation to detect and investigate the first flagged transaction.

1. Lake County Summary

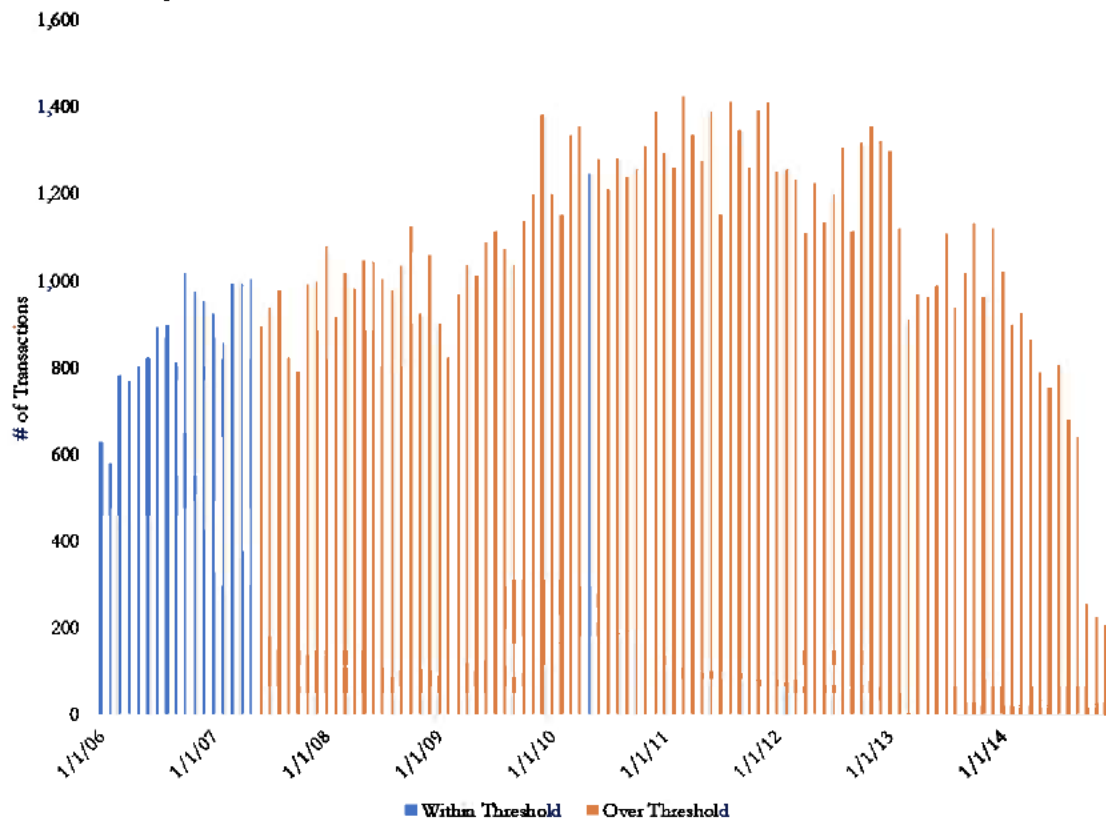
117. Table 30 reports Total MME and % of Total MME in transactions flagged in Lake County using the Trailing Six-Month Maximum Threshold.

Table 30 Trailing Six-Month Maximum Threshold Flagged Transactions, Lake County, Total MME and % MME

Year	Defendants'		%
	Total MME	Flagged MME	
2006	37,297,563	4,897,783	13.1%
2007	50,139,767	32,824,336	65.5%
2008	50,473,188	43,095,464	85.4%
2009	55,157,045	47,167,475	85.5%
2010	50,556,444	42,149,219	83.4%
2011	47,438,949	40,161,422	84.7%
2012	41,598,457	35,929,481	86.4%
2013	20,959,381	19,478,635	92.9%
2014	16,212,200	14,580,016	89.9%
Total	369,832,992	280,283,830	75.8%

118. Figure 12 illustrates total opioid transactions from Distributors to retail and chain pharmacies into Lake County from 2006 to 2014 and those transactions which would be flagged by the Trailing Six-Month Maximum Threshold methodology. The Trailing Six-Month Maximum Threshold methodology flags 83.6% of transactions accounting for 90.2% of Dosage Units, 75.8% of MME and 87.4% of drug weight shipped into Lake County.

Figure 12 Trailing Six-Month Maximum Threshold Flagged Transactions, Lake County 2006 to 2014



119. Table 31 summarizes the transactions flagged based on the Trailing Six-Month Maximum Threshold Approach in Lake County.

Table 31 Trailing Six-Month Maximum Threshold Flagged Transactions, Lake County 2006 to 2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	n/a	13,773	n/a	n/a	n/a	1,253	15,026
HBC Service Company	n/a	13,839	n/a	n/a	n/a	453	14,292
Omnicare Distribution	974	255	382	160	n/a	638	2,409
Rite Aid	n/a	6,928	n/a	n/a	n/a	519	7,447
Wal-Mart	7,270	12,341	902	214	0	663	21,390
Walgreen Co	12,344	15,207	3,976	695	0	1,510	33,732
Total	20,588	62,343	5,260	1,069	0	5,036	94,296

2. *Trumbull County Summary*

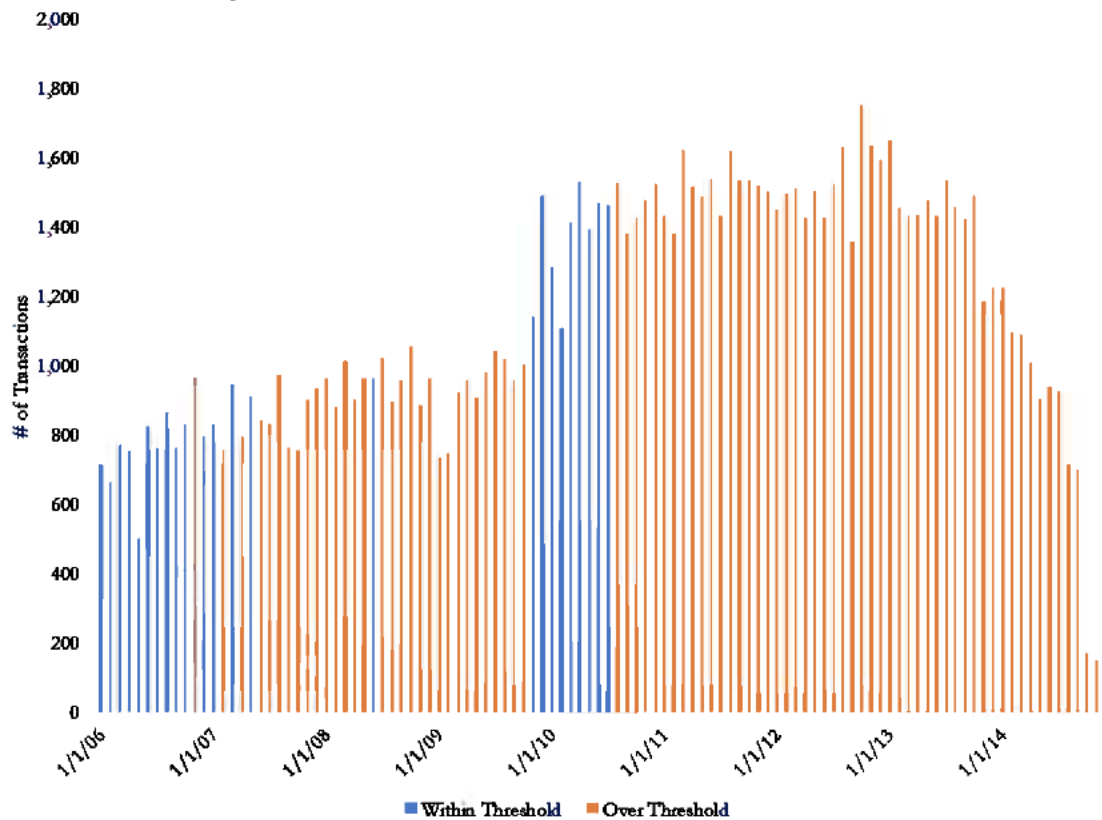
120. Table 32 reports Total MME and % of Total MME in transactions flagged in Trumbull County using the Trailing Six-Month Maximum Threshold.

Table 32 Trailing Six-Month Maximum Threshold Flagged Transactions, Trumbull County, Total MME and % MME

Year	Defendants'		%
	Total MME	Flagged MME	
2006	21,370,314	4,676,995	21.9%
2007	26,558,491	19,895,952	74.9%
2008	37,533,489	28,356,837	75.6%
2009	38,741,610	31,411,253	81.1%
2010	52,664,810	41,514,661	78.8%
2011	57,479,536	51,789,506	90.1%
2012	58,010,505	53,205,239	91.7%
2013	34,333,449	33,361,980	97.2%
2014	21,323,955	20,939,147	98.2%
Total	348,016,158	285,151,571	81.9%

121. Figure 13 illustrates total opioid transactions from Distributors to retail and chain pharmacies into Trumbull County from 2006 to 2014 and those transactions which would be flagged by the Trailing Six-Month Maximum Threshold methodology. The Trailing Six-Month Maximum Threshold methodology flags 84.9% of transactions accounting for 90.3% of Dosage Units, 81.9% of MME and 88.5% of drug weight shipped into Trumbull County.

Figure 13 Trailing Six-Month Maximum Threshold Flagged Transactions, Trumbull County 2006 to 2014



122. Table 33 summarizes the transactions flagged based on the Trailing Six-Month Maximum Threshold Approach in Trumbull County.

Table 33 Trailing Six-Month Maximum Threshold Flagged Transactions, Trumbull County 2006 to 2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	n/a	11,569	n/a	n/a	n/a	816	12,385
HBC Service Company	n/a	23,825	n/a	n/a	n/a	593	24,418
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	n/a	20,563	n/a	n/a	n/a	1,191	21,754
Wal-Mart	3,341	10,976	52	0	0	420	14,789
Walgreen Co	10,569	17,331	1,824	0	0	946	30,670
Total	13,910	84,264	1,876	0	0	3,966	104,016

B. Method 2: Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold

123. Under the second approach, when a transaction causes the number of dosage units shipped to a pharmacy in a month to exceed the highest number of dosage units shipped to the pharmacy in any one of the six preceding months, the dosage units of highest month in the preceding six months becomes threshold which is then applied in all subsequent months. For example, if the number of Dosage Units containing hydrocodone shipped from a Distributor Defendant to a pharmacy in February, March, April, May, June, and July was 5,000; 10,000; 7,000; 8,000; 9,000; and 9,500 respectively, a requested transaction in August would be flagged if it would cause the number of Dosage Units containing hydrocodone the Distributor Defendant shipped to the Pharmacy to exceed 10,000. Any reported transactions containing hydrocodone on that date and to the month-end from that Distributor Defendant to that pharmacy are flagged. This 10,000 Dosage Units number becomes the fixed monthly hydrocodone limit of this pharmacy thereafter and the excess, if any, of the pharmacy's monthly receipt in excess of 10,000 is flagged.

1. Lake County Summary

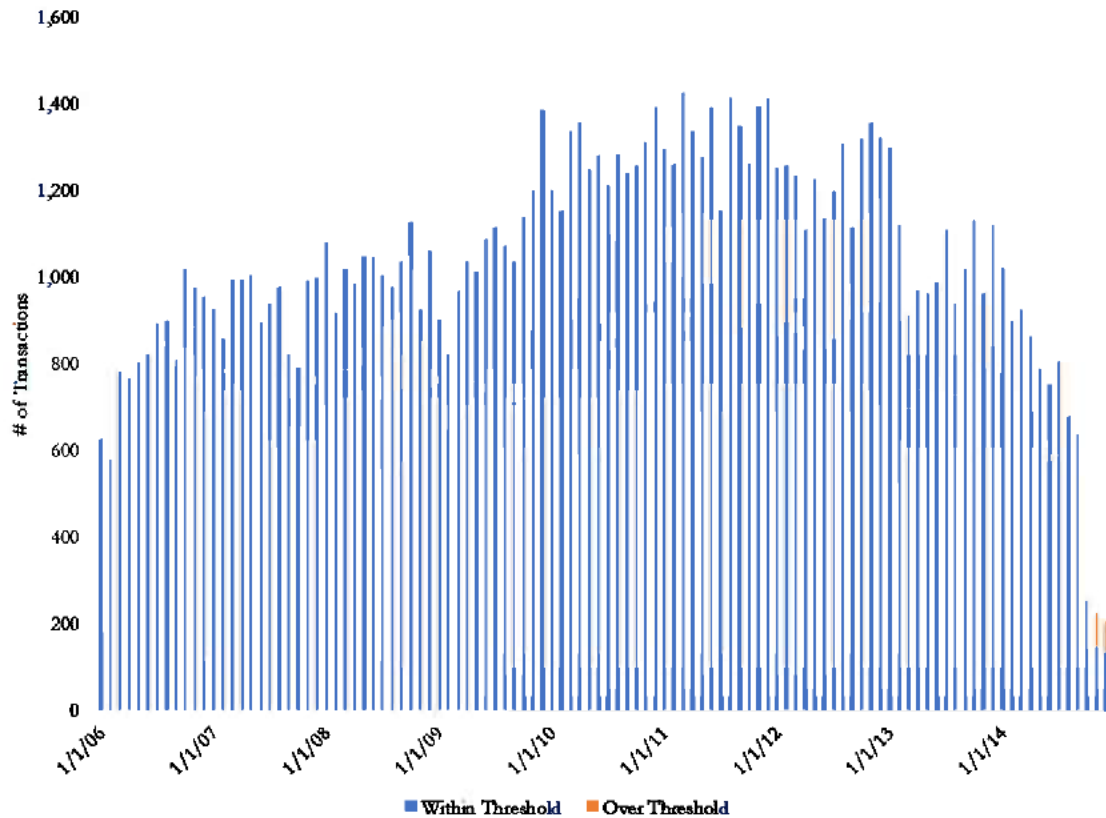
124. Table 34 reports Total MME and % of Total MME in transactions flagged in Lake County using the Trailing Six-Month Maximum, Fixed After Triggered Threshold.

Table 34 Trailing Six-Month Maximum, Fixed After Triggered Threshold Flagged Transactions, Lake County, Total MME and % MME

Year	Defendants' Total MME	Flagged MME	%
2006	37,297,563	1,107,777	3.0%
2007	50,139,767	8,247,107	16.4%
2008	50,473,188	13,518,065	26.8%
2009	55,157,045	16,808,949	30.5%
2010	50,556,444	18,552,282	36.7%
2011	47,438,949	19,323,735	40.7%
2012	41,598,457	14,922,490	35.9%
2013	20,959,381	6,784,595	32.4%
2014	16,212,200	6,162,682	38.0%
Total	369,832,992	105,427,682	28.5%

125. Figure 14 illustrates total opioid transactions from Distributors to retail and chain pharmacies into Lake County from 2006 to 2014 and those transactions which would be flagged by the Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold methodology. The Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold methodology flags 25.1% of transactions accounting for 31.7% of Dosage Units, 28.5% of MME and 31.8% of drug weight shipped into Lake County.

Figure 14 Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold Flagged Transactions, Lake County 2006 to 2014



126. Table 35 summarizes the transactions flagged based on the Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold Approach in Lake County.

Table 35 Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold Flagged Transactions, Lake County 2006 to 2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	n/a	4,113	n/a	n/a	n/a	332	4,445
HBC Service Company	n/a	1,911	n/a	n/a	n/a	103	2,014
Omnicare Distribution	796	17	70	23	n/a	8	914
Rite Aid	n/a	656	n/a	n/a	n/a	53	709
Wal-Mart	4,042	5,167	247	13	0	230	9,699
Walgreen Co	5,143	3,789	1,330	69	0	225	10,556
Total	9,981	15,653	1,647	105	0	951	28,337

2. *Trumbull County Summary*

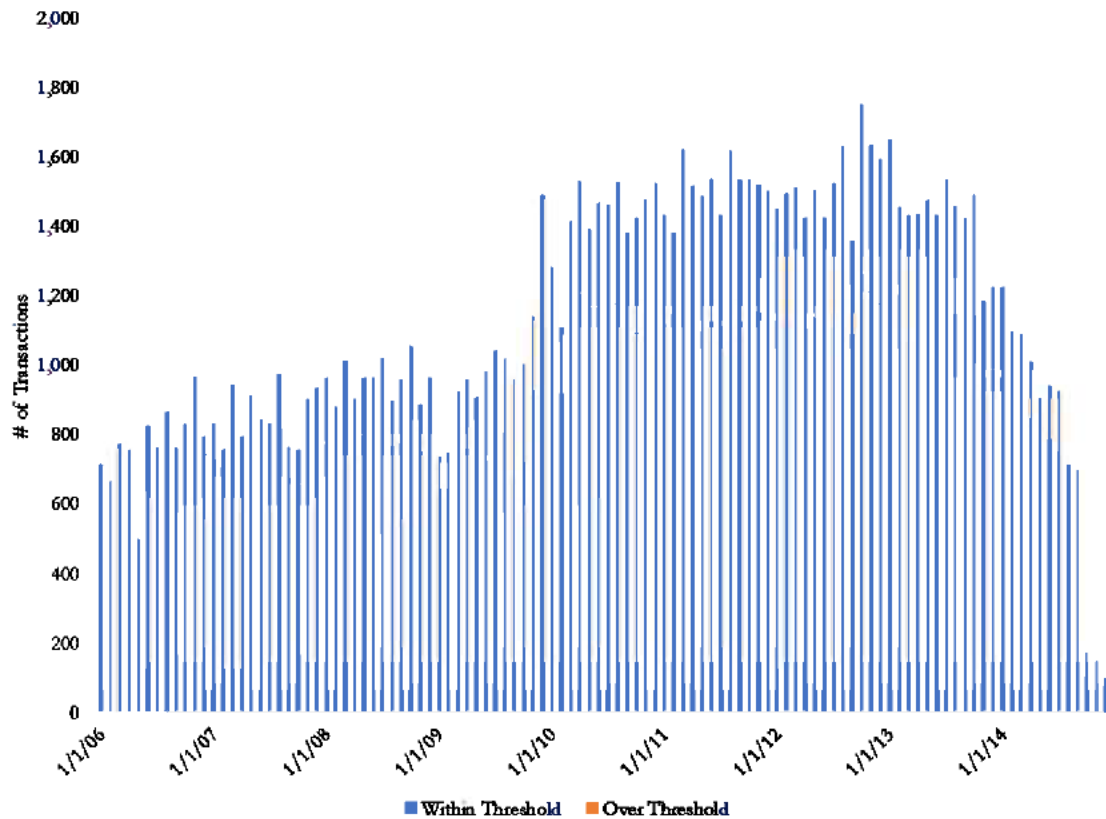
127. Table 36 reports Total MME and % of Total MME in transactions flagged in Trumbull County using the Trailing Six-Month Maximum, Fixed After Triggered Threshold.

Table 36 Trailing Six-Month Maximum, Fixed After Triggered Threshold Flagged Transactions, Trumbull County, Total MME and % MME

Year	Defendants'		%
	Total MME	Flagged MME	
2006	21,370,314	795,608	3.7%
2007	26,558,491	3,746,169	14.1%
2008	37,533,489	8,904,124	23.7%
2009	38,741,610	10,292,510	26.6%
2010	52,664,810	17,247,578	32.7%
2011	57,479,536	23,177,201	40.3%
2012	58,010,505	24,786,154	42.7%
2013	34,333,449	10,437,413	30.4%
2014	21,323,955	5,740,666	26.9%
Total	348,016,158	105,127,422	30.2%

128. Figure 15 illustrates total opioid transactions from Distributors to retail and chain pharmacies into Trumbull County from 2006 to 2014 and those transactions which would be flagged by the Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold methodology. The Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold methodology flags 20.0% of transactions accounting for 24.2% of Dosage Units, 30.2% of MME and 27.9% of drug weight shipped into Trumbull County.

Figure 15 Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold Flagged Transactions, Trumbull County 2006 to 2014



129. Table 37 summarizes the transactions flagged based on the Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold Approach in Trumbull County.

Table 37 Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold Flagged Transactions, Trumbull County 2006 to 2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	n/a	1,066	n/a	n/a	n/a	96	1,162
HBC Service Company	n/a	2,024	n/a	n/a	n/a	95	2,119
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	n/a	5,284	n/a	n/a	n/a	212	5,496
Wal-Mart	1,010	1,296	3	0	0	66	2,375
Walgreen Co	5,957	7,041	196	0	0	107	13,301
Total	6,967	16,711	199	0	0	576	24,453

C. Method 3: Twice Trailing Twelve-Month Average Pharmacy Dosage Units

130. Under the third approach, I identify transactions that cause the number of Dosage Units shipped by a Distributor Defendant to a pharmacy in a calendar month to exceed twice the trailing twelve-month average Dosage Units to retail and chain pharmacies served by the Distributor Defendant.

1. Lake County Summary

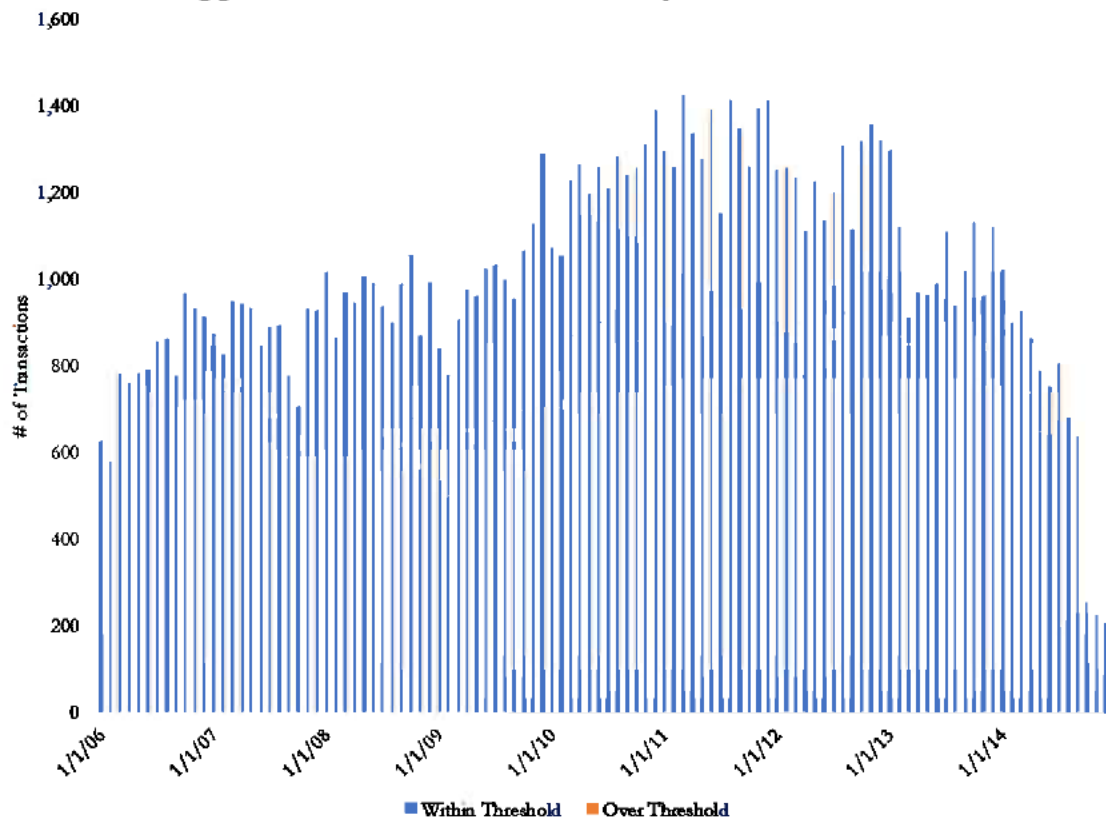
131. Table 38 reports Total MME and % of Total MME in transactions flagged in Lake County using the Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold.

Table 38 Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Lake County, Total MME and % MME

Year	Defendants'		%
	Total MME	Flagged MME	
2006	27,182,420	0	0.0%
2007	31,087,227	10,843,105	34.9%
2008	36,450,880	20,512,677	56.3%
2009	39,528,347	23,119,480	58.5%
2010	44,599,335	25,952,202	58.2%
2011	47,438,949	28,179,921	59.4%
2012	41,598,457	24,210,141	58.2%
2013	20,959,381	7,605,544	36.3%
2014	16,212,200	7,607,710	46.9%
Total	305,057,196	148,030,779	48.5%

132. Figure 16 illustrates total opioid transactions from Distributors to retail and chain pharmacies into Lake County from 2006 to 2014 and those transactions which would be flagged by the Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold methodology. The Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold methodology flags 24.3% of transactions accounting for 29.1% of Dosage Units, 48.5% of MME and 41.2% of drug weight shipped into Lake County.

Figure 16 Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Lake County 2006 to 2014



133. Table 39 summarizes the transactions flagged based on the Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Approach in Lake County.

Table 39 Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Lake County 2006 to 2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	n/a	0	n/a	n/a	n/a	449	449
HBC Service Company	n/a	0	n/a	n/a	n/a	230	230
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	n/a	2,058	n/a	n/a	n/a	110	2,168
Wal-Mart	5,746	0	826	426	29	1,589	8,616
Walgreen Co	8,731	0	2,948	631	33	2,875	15,218
Total	14,477	2,058	3,774	1,057	62	5,253	26,681

2. *Trumbull County Summary*

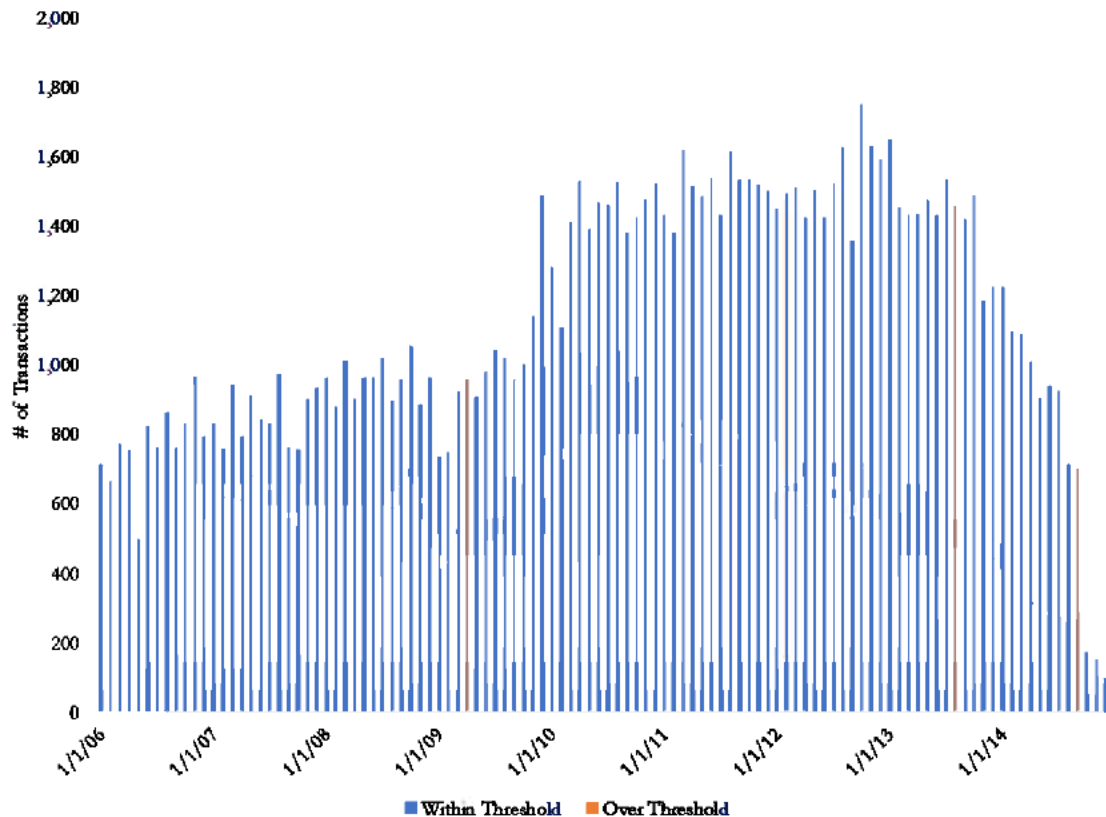
134. Table 40 reports Total MME and % of Total MME in transactions flagged in Trumbull County using the Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold.

Table 40 Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Trumbull County, Total MME and % MME

Year	Defendants'		%
	Total MME	Flagged MME	
2006	21,370,314	0	0.0%
2007	26,558,491	6,175,170	23.3%
2008	37,533,489	10,163,535	27.1%
2009	38,741,610	14,218,567	36.7%
2010	52,664,810	19,719,945	37.4%
2011	57,479,536	30,684,694	53.4%
2012	58,010,505	33,288,579	57.4%
2013	34,333,449	22,458,452	65.4%
2014	21,323,955	15,872,588	74.4%
Total	348,016,158	152,581,530	43.8%

135. Figure 17 illustrates total opioid transactions from Distributors to retail and chain pharmacies into Trumbull County from 2006 to 2014 and those transactions which would be flagged by the Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold methodology. The Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold methodology flags 43.2% of transactions accounting for 53.4% of Dosage Units, 43.8% of MME and 48.6% of drug weight shipped into Trumbull County.

Figure 17 Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Trumbull County 2006 to 2014



136. Table 41 summarizes the transactions flagged based on the Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Approach in Trumbull County.

Table 41 Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Trumbull County 2006 to 2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	n/a	4,810	n/a	n/a	n/a	510	5,320
HBC Service Company	n/a	15,191	n/a	n/a	n/a	524	15,715
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	n/a	18,048	n/a	n/a	n/a	580	18,628
Wal-Mart	547	4,559	50	17	0	494	5,667
Walgreen Co	3,188	3,253	391	0	0	749	7,581
Total	3,735	45,861	441	17	0	2,857	52,911

D. Method 4: Three Times Trailing Twelve-Month Average Pharmacy Dosage Units

137. Under the fourth approach, I identify transactions that cause the number of Dosage Units shipped by a Distributor Defendant to a pharmacy in a calendar month to exceed three times the trailing twelve-month average Dosage Units to retail and chain pharmacies served by the Distributor Defendant.

1. *Lake County Summary*

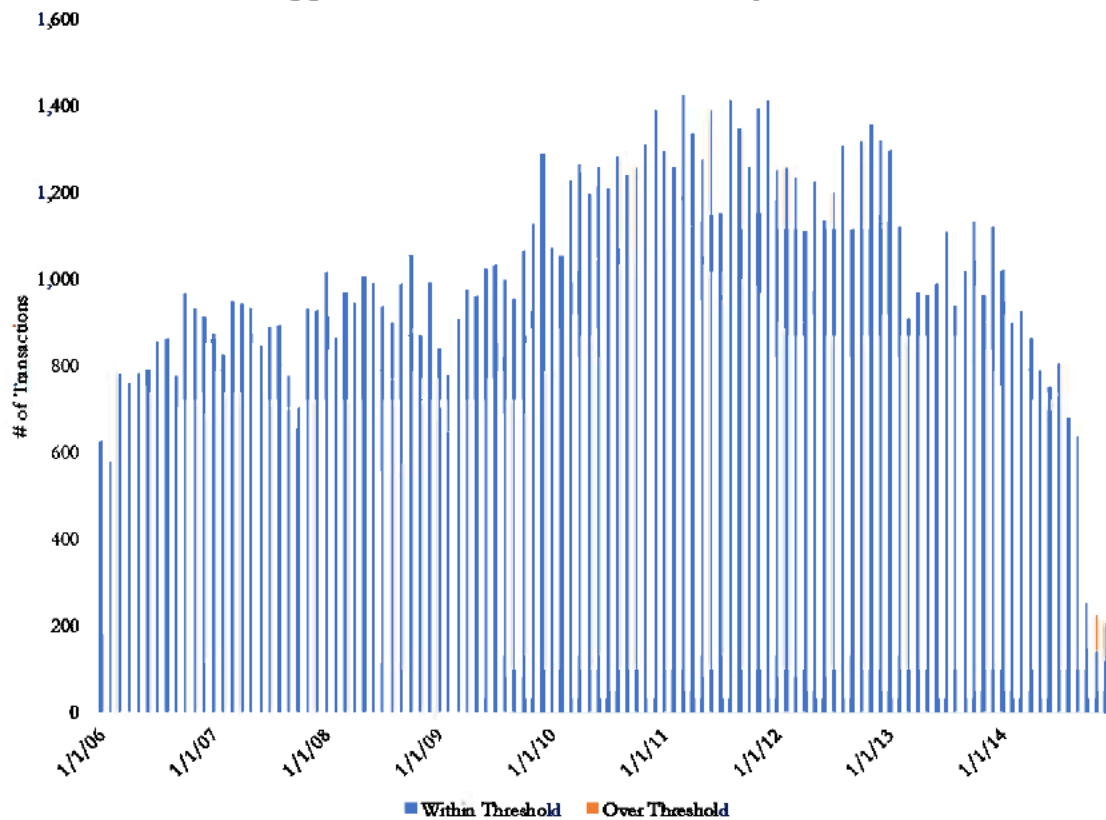
138. Table 42 reports Total MME and % of Total MME in transactions flagged in Lake County using the Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold.

Table 42 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Lake County, Total MME and % MME

Year	Defendants' Total MME	Flagged MME	%
2006	27,182,420	0	0.0%
2007	31,087,227	4,437,951	14.3%
2008	36,450,880	11,502,204	31.6%
2009	39,528,347	13,586,802	34.4%
2010	44,599,335	18,358,695	41.2%
2011	47,438,949	19,883,221	41.9%
2012	41,598,457	17,879,186	43.0%
2013	20,959,381	5,094,771	24.3%
2014	16,212,200	5,673,943	35.0%
Total	305,057,196	96,416,772	31.6%

139. Figure 18 illustrates total opioid transactions from Distributors to retail and chain pharmacies into Lake County from 2006 to 2014 and those transactions which would be flagged by the Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold methodology. The Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold methodology flags 12.9% of transactions accounting for 16.9% of Dosage Units, 31.6% of MME and 22.2% of drug weight shipped into Lake County.

Figure 18 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Lake County 2006 to 2014



140. Table 43 summarizes the transactions flagged based on the Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Approach in Lake County.

Table 43 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Lake County 2006 to 2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	n/a	0	n/a	n/a	n/a	1	1
HBC Service Company	n/a	0	n/a	n/a	n/a	0	0
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	n/a	0	n/a	n/a	n/a	0	0
Wal-Mart	3,947	0	508	214	0	895	5,564
Walgreen Co	5,762	0	1,678	141	0	977	8,558
Total	9,709	0	2,186	355	0	1,873	14,123

2. *Trumbull County Summary*

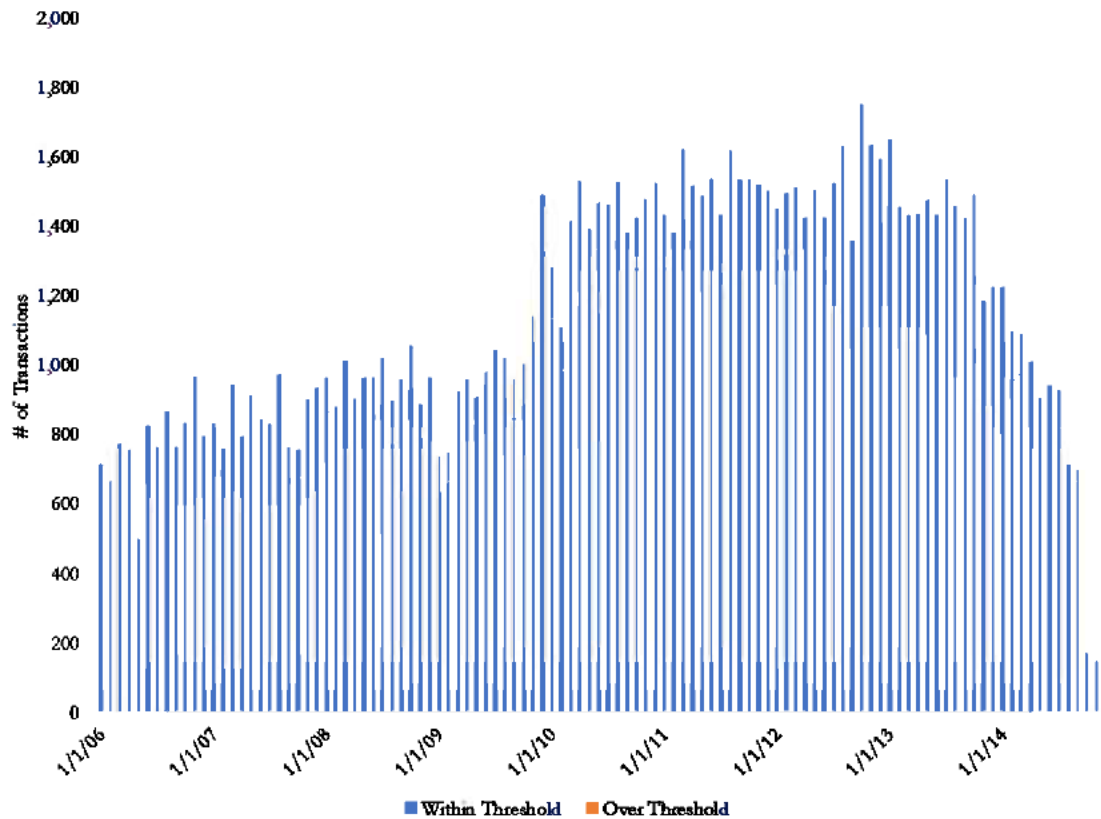
141. Table 44 reports Total MME and % of Total MME in transactions flagged in Trumbull County using the Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold.

Table 44 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Trumbull County, Total MME and % MME

Year	Defendants' Total MME	Flagged MME	%
2006	21,370,314	0	0.0%
2007	26,558,491	2,527,261	9.5%
2008	37,533,489	4,159,035	11.1%
2009	38,741,610	4,613,198	11.9%
2010	52,664,810	6,385,273	12.1%
2011	57,479,536	6,663,224	11.6%
2012	58,010,505	7,011,725	12.1%
2013	34,333,449	7,326,989	21.3%
2014	21,323,955	4,442,164	20.8%
Total	348,016,158	43,128,867	12.4%

142. Figure 19 illustrates total opioid transactions from Distributors to retail and chain pharmacies into Trumbull County from 2006 to 2014 and those transactions which would be flagged by the Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold methodology. The Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold methodology flags 10.4% of transactions accounting for 18.1% of Dosage Units, 12.4% of MME and 14.7% of drug weight shipped into Trumbull County.

Figure 19 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Trumbull County 2006 to 2014



143. Table 45 summarizes the transactions flagged based on the Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Approach in Trumbull County.

Table 45 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Trumbull County 2006 to 2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	n/a	1,707	n/a	n/a	n/a	0	1,707
HBC Service Company	n/a	0	n/a	n/a	n/a	108	108
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	n/a	9,977	n/a	n/a	n/a	348	10,325
Wal-Mart	0	0	0	0	0	148	148
Walgreen Co	0	0	0	0	0	501	501
Total	0	11,684	0	0	0	1,105	12,789

E. Method 5: Maximum 8,000 Dosage Units Monthly

144. Under the fifth approach, I identify transactions that cause the number of Dosage Units shipped by a Distributor Defendant to a pharmacy in a calendar month to exceed 8,000 Dosage Units.⁴⁰

⁴⁰ McKesson Operations Manual for Pharma Distribution dated May 16, 2007 shows the dosage threshold of 8,000 on oxycodone or hydrocodone (MCK-WVAG-003-0001047, MCKMDL00355251).

1. Lake County Summary

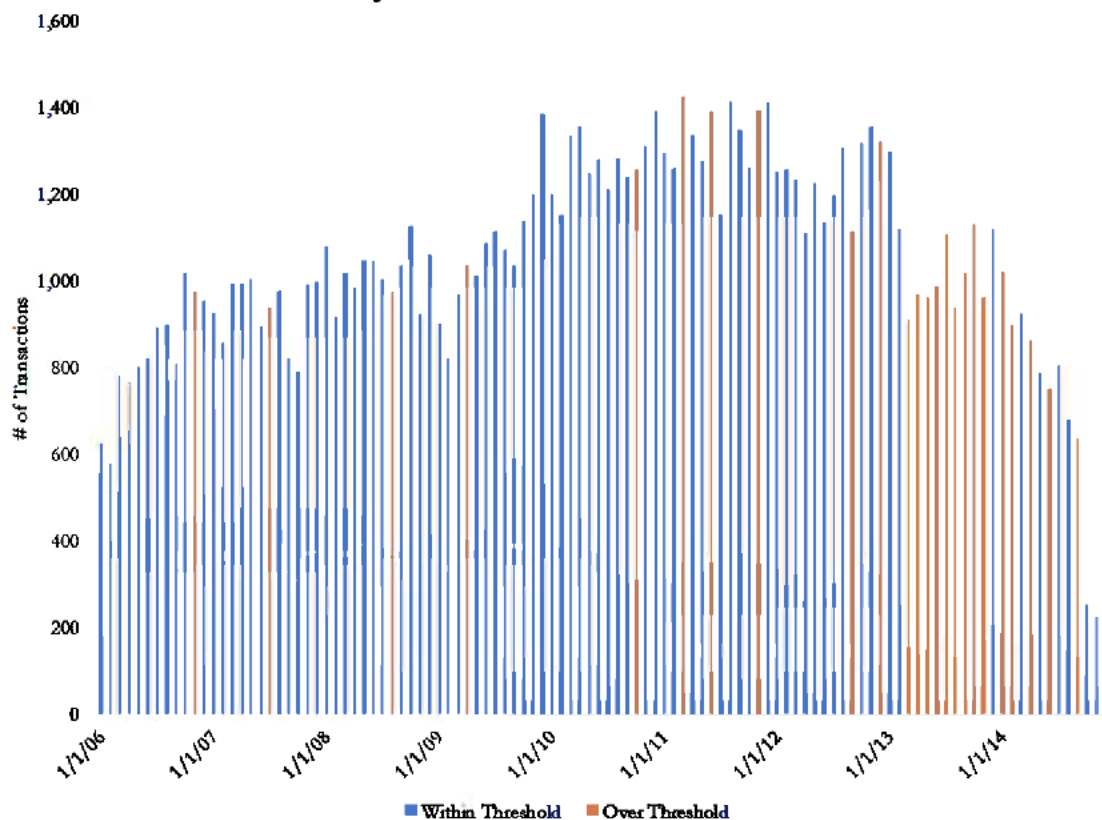
145. Table 46 reports Total MME and % of Total MME in transactions flagged in Lake County using the Maximum 8,000 Dosage Units Monthly Threshold.

Table 46 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Lake County, Total MME and % MME

Year	Defendants'		%
	Total MME	Flagged MME	
2006	37,297,563	13,711,546	36.8%
2007	50,139,767	21,989,478	43.9%
2008	50,473,188	26,066,728	51.6%
2009	55,157,045	29,625,200	53.7%
2010	50,556,444	32,828,243	64.9%
2011	47,438,949	33,430,057	70.5%
2012	41,598,457	29,211,866	70.2%
2013	20,959,381	16,150,632	77.1%
2014	16,212,200	12,285,194	75.8%
Total	369,832,992	215,298,944	58.2%

146. Figure 20 illustrates total opioid transactions from Distributors to retail and chain pharmacies into Lake County from 2006 to 2014 and those transactions which would be flagged by the Maximum 8,000 Dosage Units Monthly Threshold methodology. The Maximum 8,000 Dosage Units Monthly Threshold methodology flags 68.5% of transactions accounting for 80.1% of Dosage Units, 58.2% of MME and 59.8% of drug weight shipped into Lake County.

Figure 20 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Lake County 2006 to 2014



147. Table 47 summarizes the transactions flagged based on the Maximum 8,000 Dosage Units Monthly Threshold Approach in Lake County.

Table 47 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Lake County 2006 to 2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	n/a	13,757	n/a	n/a	n/a	0	13,757
HBC Service Company	n/a	13,325	n/a	n/a	n/a	0	13,325
Omnicare Distribution	1,125	324	0	0	n/a	0	1,449
Rite Aid	n/a	4,190	n/a	n/a	n/a	0	4,190
Wal-Mart	5,932	10,170	0	0	0	0	16,102
Walgreen Co	12,570	15,826	0	0	0	0	28,396
Total	19,627	57,592	0	0	0	0	77,219

2. *Trumbull County Summary*

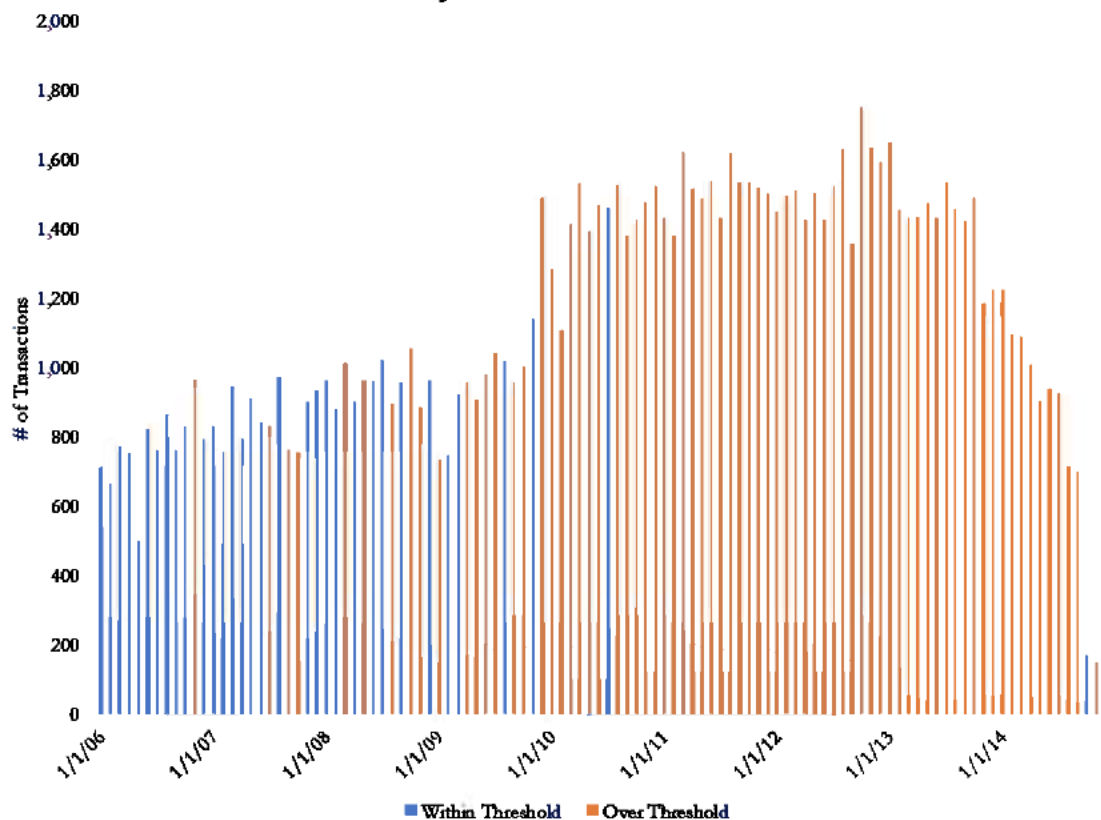
148. Table 48 reports Total MME and % of Total MME in transactions flagged in Trumbull County using the Maximum 8,000 Dosage Units Monthly Threshold.

Table 48 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Trumbull County, Total MME and % MME

Year	Defendants'		%
	Total MME	Flagged MME	
2006	21,370,314	10,954,813	51.3%
2007	26,558,491	16,436,479	61.9%
2008	37,533,489	25,676,001	68.4%
2009	38,741,610	28,005,995	72.3%
2010	52,664,810	42,120,227	80.0%
2011	57,479,536	47,166,289	82.1%
2012	58,010,505	47,558,590	82.0%
2013	34,333,449	30,875,638	89.9%
2014	21,323,955	19,640,502	92.1%
Total	348,016,158	268,434,534	77.1%

149. Figure 21 illustrates total opioid transactions from Distributors to retail and chain pharmacies into Trumbull County from 2006 to 2014 and those transactions which would be flagged by the Maximum 8,000 Dosage Units Monthly Threshold methodology. The Maximum 8,000 Dosage Units Monthly Threshold methodology flags 83.2% of transactions accounting for 90.5% of Dosage Units, 77.1% of MME and 73.4% of drug weight shipped into Trumbull County.

Figure 21 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Trumbull County 2006 to 2014



150. Table 49 summarizes the transactions flagged based on the Maximum 8,000 Dosage Units Monthly Threshold Approach in Trumbull County.

Table 49 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Trumbull County 2006 to 2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	n/a	12,966	n/a	n/a	n/a	0	12,966
HBC Service Company	n/a	26,916	n/a	n/a	n/a	0	26,916
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	n/a	22,595	n/a	n/a	n/a	0	22,595
Wal-Mart	595	11,033	0	0	0	0	11,628
Walgreen Co	9,587	18,267	0	0	0	0	27,854
Total	10,182	91,777	0	0	0	0	101,959

F. Method 6: Maximum Daily Dosage Units

151. Under the sixth approach, I identify transactions that cause the number of Dosage Units shipped by a Distributor Defendant to a pharmacy in a day to exceed a specified number of Dosage Units that varies by drug type and within some drug types by formulation.⁴¹

⁴¹ Maximum Daily Dosage Units used as specified in CAH_MDLPRIORPRO_DEA07_01384160.

1. Lake County Summary

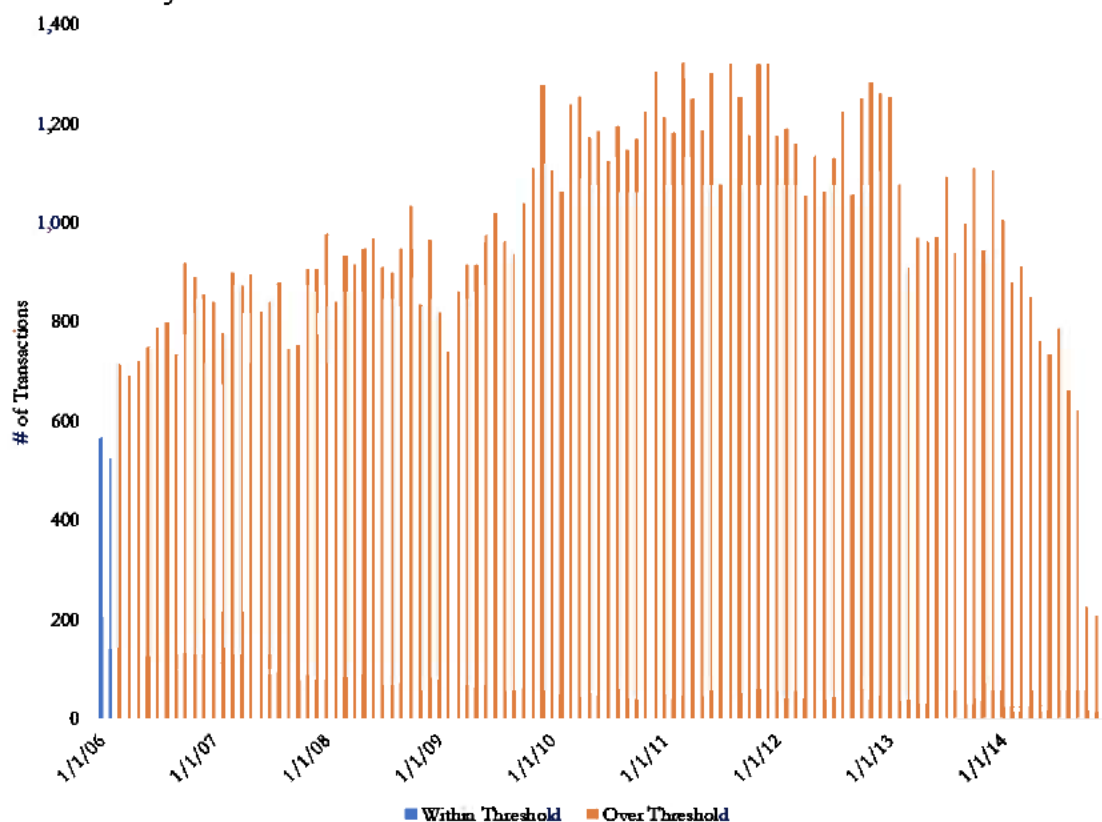
152. Table 50 reports Total MME and % of Total MME in transactions flagged in Lake County using the Maximum Daily Dosage Units Threshold.

Table 50 Maximum Daily Dosage Units Threshold Flagged Transactions, Lake County, Total MME and % MME

Year	Defendants'		%
	Total MME	Flagged MME	
2006	23,843,020	20,242,493	84.9%
2007	32,196,059	29,012,939	90.1%
2008	37,028,284	35,326,948	95.4%
2009	39,610,242	38,337,782	96.8%
2010	41,143,220	40,147,923	97.6%
2011	40,392,660	39,521,506	97.8%
2012	35,987,549	35,136,249	97.6%
2013	19,545,992	18,834,815	96.4%
2014	14,792,730	14,282,941	96.6%
Total	284,539,757	270,843,597	95.2%

153. Figure 22 illustrates total opioid transactions from Distributors to retail and chain pharmacies into Lake County from 2006 to 2014 and those transactions which would be flagged by the Maximum Daily Dosage Units Threshold methodology. The Maximum Daily Dosage Units Threshold methodology flags 93.7% of transactions accounting for 95.0% of Dosage Units, 95.2% of MME and 83.6% of drug weight shipped into Lake County.

Figure 22 Maximum Daily Dosage Units Threshold Flagged Transactions, Lake County 2006 to 2014



154. Table 51 summarizes the transactions flagged based on the Maximum Daily Dosage Units Threshold Approach in Lake County.

Table 51 Maximum Daily Dosage Units Threshold Flagged Transactions, Lake County 2006 to 2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	n/a	15,589	n/a	n/a	n/a	735	16,324
HBC Service Company	n/a	15,507	n/a	n/a	n/a	3	15,510
Omnicare Distribution	996	328	450	212	n/a	104	2,090
Rite Aid	n/a	7,774	n/a	n/a	n/a	83	7,857
Wal-Mart	7,290	12,548	990	279	n/a	282	21,389
Walgreen Co	13,155	16,748	4,341	908	n/a	159	35,311
Total	21,441	68,494	5,781	1,399	n/a	1,366	98,481

2. *Trumbull County Summary*

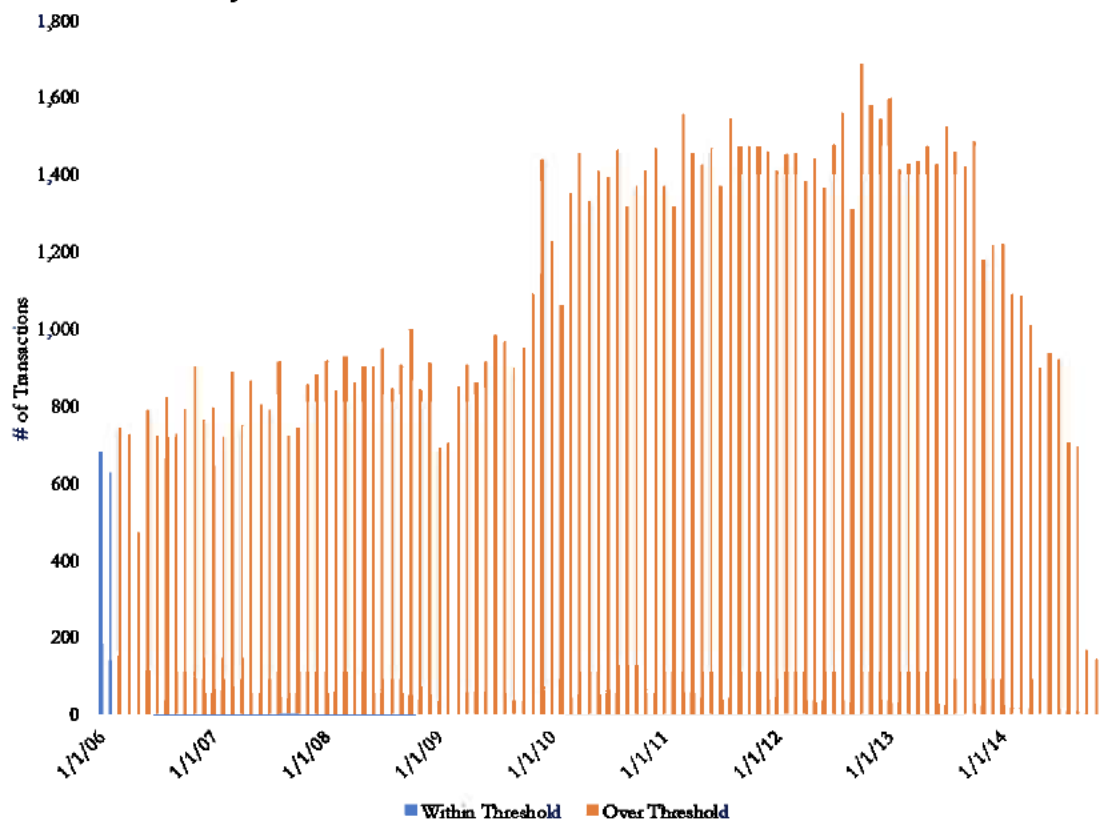
155. Table 52 reports Total MME and % of Total MME in transactions flagged in Trumbull County using the Maximum Daily Dosage Units Threshold.

Table 52 Maximum Daily Dosage Units Threshold Flagged Transactions, Trumbull County, Total MME and % MME

Year	Defendants'		%
	Total MME	Flagged MME	
2006	18,730,617	15,247,848	81.4%
2007	23,321,861	21,699,864	93.0%
2008	32,041,680	30,732,653	95.9%
2009	33,335,275	32,191,003	96.6%
2010	47,186,246	45,892,476	97.3%
2011	52,323,601	51,308,640	98.1%
2012	53,714,995	52,968,484	98.6%
2013	33,496,545	33,013,416	98.6%
2014	21,178,120	20,776,528	98.1%
Total	315,328,939	303,830,911	96.4%

156. Figure 23 illustrates total opioid transactions from Distributors to retail and chain pharmacies into Trumbull County from 2006 to 2014 and those transactions which would be flagged by the Maximum Daily Dosage Units Threshold methodology. The Maximum Daily Dosage Units Threshold methodology flags 95.5% of transactions accounting for 96.8% of Dosage Units, 96.4% of MME and 88.1% of drug weight shipped into Trumbull County.

Figure 23 Maximum Daily Dosage Units Threshold Flagged Transactions, Trumbull County 2006 to 2014



157. Table 53 summarizes the transactions flagged based on the Maximum Daily Dosage Units Threshold Approach in Trumbull County.

Table 53 Maximum Daily Dosage Units Threshold Flagged Transactions, Trumbull County 2006 to 2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	n/a	13,081	n/a	n/a	n/a	308	13,389
HBC Service Company	n/a	27,036	n/a	n/a	n/a	134	27,170
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	n/a	22,906	n/a	n/a	n/a	354	23,260
Wal-Mart	3,285	12,655	52	17	n/a	205	16,214
Walgreen Co	11,092	18,604	2,124	202	n/a	702	32,724
Total	14,377	94,282	2,176	219	n/a	1,703	112,757

G. Method 7: Maximum Monthly, Trailing Six-month Threshold on Rolling 30-Day Dosage Units

158. Under this approach, I identify transactions that cause the number of Dosage Units shipped by a Distributor Defendant to a pharmacy in a rolling 30-day window to exceed the highest number of Dosage Units shipped by the Distributor Defendant to the pharmacy in any one of the six preceding calendar months.⁴² Any reported transactions containing the same drug group on that date and thereafter are flagged.

⁴² A rolling 30-day window in my calculation includes today and the prior 29 days.

1. Lake County Summary

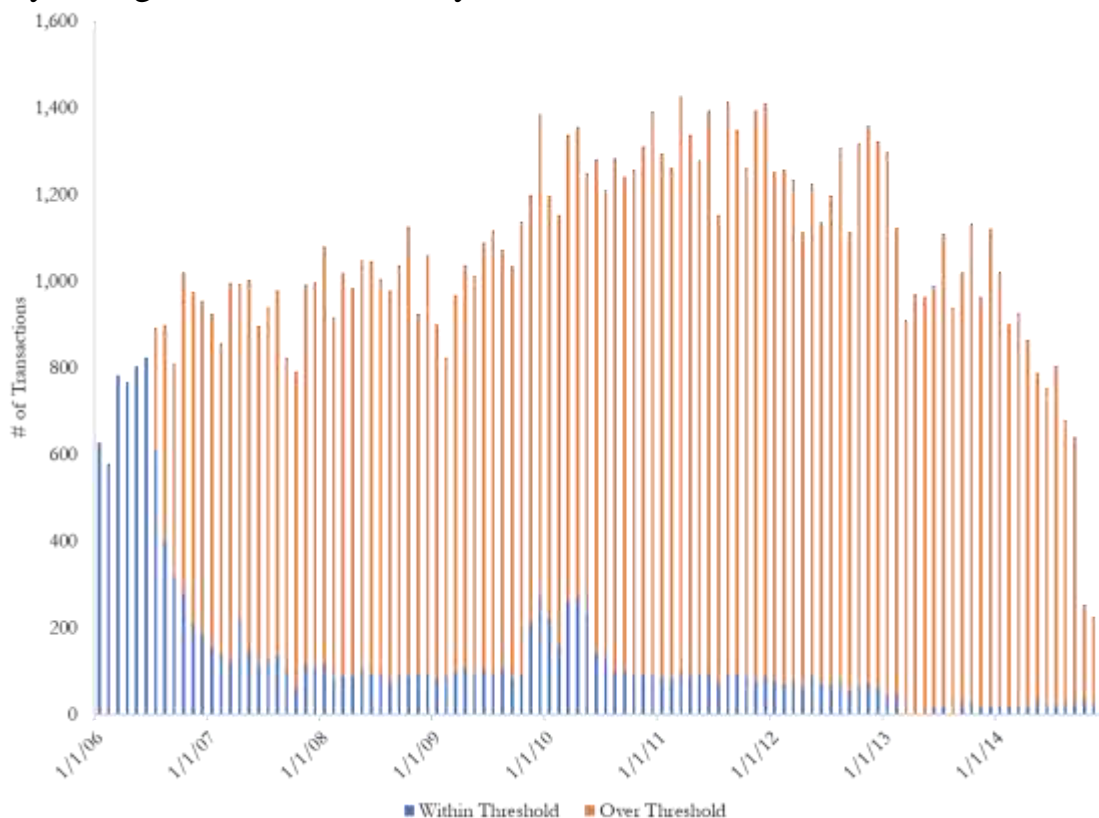
159. Table 54 reports Total MME and % of Total MME in transactions flagged in Lake County using Method 7.

Table 54 Maximum Monthly, Trailing Six-month Threshold on Rolling 30-Day Dosage Units, Lake County, Total MME and % MME

Year	Defendants'		%
	Total MME	Flagged MME	
2006	37,297,563	11,099,798	29.8%
2007	50,139,767	40,441,018	80.7%
2008	50,473,188	43,392,710	86.0%
2009	55,157,045	47,419,618	86.0%
2010	50,556,444	42,906,046	84.9%
2011	47,438,949	40,487,002	85.3%
2012	41,598,457	36,014,437	86.6%
2013	20,959,381	19,485,987	93.0%
2014	16,212,200	14,580,016	89.9%
Total	369,832,992	295,826,633	80.0%

160. Figure 24 illustrates total opioid transactions from Distributors to retail and chain pharmacies into Lake County from 2006 to 2014 and those transactions which would be flagged by the Method 7. It flags 86.9% of transactions accounting for 93.4% of Dosage Units, 80.0% of MME and 90.9% of drug weight shipped into Lake County.

Figure 24 Maximum Monthly, Trailing Six-month Threshold on Rolling 30-Day Dosage Units, Lake County 2006 to 2014



161. Table 55 summarizes the transactions flagged based on Maximum Monthly, Trailing Six-month Threshold on Rolling 30-Day Dosage Units method in Lake County.

Table 55 Maximum Monthly, Trailing Six-month Threshold on Rolling 30-Day Dosage Units Flagged Transactions, Lake County 2006 to 2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	n/a	14,489	n/a	n/a	n/a	1,317	15,806
HBC Service Company	n/a	14,377	n/a	n/a	n/a	489	14,866
Omnicare Distribution	1,057	283	382	181	n/a	712	2,615
Rite Aid	n/a	7,301	n/a	n/a	n/a	595	7,896
Wal-Mart	7,421	12,403	953	328	0	676	21,781
Walgreen Co	12,660	15,733	4,175	929	17	1,603	35,117
Total	21,138	64,586	5,510	1,438	17	5,392	98,081

2. *Trumbull County Summary*

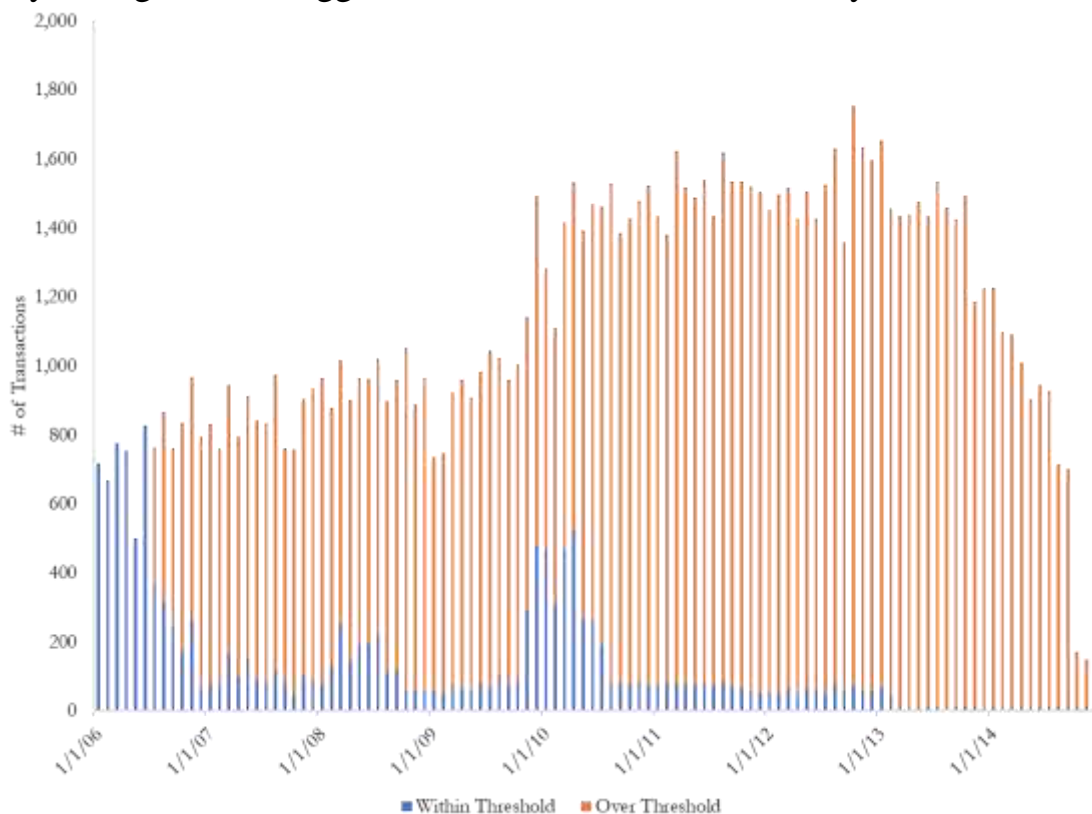
162. Table 56 reports Total MME and % of Total MME in transactions flagged in Trumbull County using the Maximum Monthly, Trailing Six-month Threshold on Rolling 30-Day Dosage Units method.

Table 56 Maximum Monthly, Trailing Six-month Threshold on Rolling 30-Day Dosage Units Flagged Transactions, Trumbull County, Total MME and % MME

Year	Defendants' Total MME	Flagged MME	%
2006	21,370,314	7,481,137	35.0%
2007	26,558,491	21,248,554	80.0%
2008	37,533,489	29,240,467	77.9%
2009	38,741,610	31,870,837	82.3%
2010	52,664,810	43,758,951	83.1%
2011	57,479,536	51,948,472	90.4%
2012	58,010,505	53,459,429	92.2%
2013	34,333,449	33,370,491	97.2%
2014	21,323,955	20,939,147	98.2%
Total	348,016,158	293,317,486	84.3%

163. Figure 25 illustrates total opioid transactions from Distributors to pharmacies into Trumbull County from 2006 to 2014 and those transactions which would be flagged by the Method 7. It flags 88.0% of transactions accounting for 93.1% of Dosage Units, 84.3% of MME and 91.7% of drug weight shipped into Trumbull County.

Figure 25 Maximum Monthly, Trailing Six-month Threshold on Rolling 30-Day Dosage Units Flagged Transactions, Trumbull County 2006 to 2014



164. Table 57 summarizes the transactions flagged based on the Maximum Monthly, Trailing Six-month Threshold on Rolling 30-Day Dosage Units method in Trumbull County.

Table 57 Maximum Monthly, Trailing Six-month Threshold on Rolling 30-Day Dosage Units Flagged Transactions, Trumbull County 2006 to 2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	n/a	11,956	n/a	n/a	n/a	840	12,796
HBC Service Company	n/a	24,759	n/a	n/a	n/a	612	25,371
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	n/a	21,440	n/a	n/a	n/a	1,394	22,834
Wal-Mart	3,505	11,600	52	0	0	444	15,601
Walgreen Co	10,696	17,566	2,019	7	0	1,019	31,307
Total	14,201	87,321	2,071	7	0	4,309	107,909

VIII. Lake County and Trumbull County, OH Opioid Chain Pharmacy Summary

165. I have been asked by Counsel to assume that Chain Pharmacy Distributors may have had knowledge of - or information available to inform them of - opioid shipments from all Distributors to the Chain Pharmacy Distributor's affiliated pharmacies. I have re-run the seven identification routines described above assuming that the Chain Pharmacy Distributors could have flagged transactions based on this expanded information set and report the results for the Chain Pharmacy Distributors in Table 58 through Table 71 below. Additional charts and tables reflecting the result of applying methodologies below to each Chain Pharmacy Distributor are in Appendix 8B.

A. Method 1: Maximum Monthly, Trailing Six-month Threshold

1. Lake County Summary

166. Table 58 summarizes the Chain Pharmacy Distributors transactions flagged based on the Trailing Six-Month Maximum Threshold Approach in Lake County, regardless of the distributors.

Table 58 Trailing Six-Month Maximum Threshold Flagged Transactions, Lake County 2006-2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	11,433	15,672	1,527	329	278	1,838	31,077
HBC Service Company	8,993	25,528	799	165	0	1,495	36,980
Omnicare Distribution	1,831	440	913	459	0	905	4,548
Rite Aid	17,724	9,272	2,853	626	1,110	3,561	35,146
Wal-Mart	8,253	13,489	1,025	282	76	755	23,880
Walgreen Co	16,640	17,867	5,840	1,117	195	2,092	43,751
Total	64,874	82,268	12,957	2,978	1,659	10,646	175,382

2. *Trumbull County Summary*

167. Table 59 summarizes the Chain Pharmacy Distributors transactions flagged based on the Trailing Six-Month Maximum Threshold Approach in Trumbull County, regardless of the distributors.

Table 59 Trailing Six-Month Maximum Threshold Flagged Transactions, Trumbull County 2006-2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	6,288	13,094	548	0	0	949	20,879
HBC Service Company	12,549	48,813	1,493	80	0	2,724	65,659
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	20,920	26,775	3,149	117	417	1,744	53,122
Wal-Mart	3,533	11,730	62	0	0	465	15,790
Walgreen Co	14,942	20,373	3,619	0	115	2,506	41,555
Total	58,232	120,785	8,871	197	532	8,388	197,005

B. Method 2: Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold

1. Lake County Summary

168. Table 60 summarizes the Chain Pharmacy Distributors transactions flagged based on the Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold Approach in Lake County, regardless of the distributors.

Table 60 Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold Flagged Transactions, Lake County 2006-2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	6,699	5,155	499	37	44	426	12,860
HBC Service Company	5,434	11,901	83	10	0	307	17,735
Omnicare Distribution	367	23	137	62	0	45	634
Rite Aid	7,152	1,171	825	60	407	175	9,790
Wal-Mart	4,660	5,586	322	16	1	273	10,858
Walgreen Co	6,192	4,171	1,848	93	25	226	12,555
Total	30,504	28,007	3,714	278	477	1,452	64,432

2. Trumbull County Summary

169. Table 61 summarizes the Chain Pharmacy Distributors transactions flagged based on the Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold Approach in Trumbull County, regardless of the distributors.

Table 61 Trailing Six-month Maximum Monthly, Fixed After First Triggered Threshold Flagged Transactions, Trumbull County 2006-2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	1,266	1,727	21	0	0	133	3,147
HBC Service Company	2,364	14,612	95	3	0	289	17,363
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	8,375	7,149	517	4	84	228	16,357
Wal-Mart	1,065	1,478	3	0	0	66	2,612
Walgreen Co	8,705	8,536	580	0	10	126	17,957
Total	21,775	33,502	1,216	7	94	842	57,436

C. Method 3: Twice Trailing Twelve-Month Average Pharmacy Dosage Units

1. Lake County Summary

170. Table 62 summarizes the Chain Pharmacy Distributors transactions flagged based on the Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Approach in Lake County, regardless of the distributors.

Table 62 Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Lake County 2006-2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	7,568	1,828	884	285	431	2,795	13,791
HBC Service Company	2,034	0	604	378	349	2,051	5,416
Omnicare Distribution	1,673	314	864	348	0	713	3,912
Rite Aid	14,853	2,753	2,663	727	1,179	4,068	26,243
Wal-Mart	6,551	0	949	508	133	1,944	10,085
Walgreen Co	12,057	0	3,921	789	458	4,516	21,741
Total	44,736	4,895	9,885	3,035	2,550	16,087	81,188

2. *Trumbull County Summary*

171. Table 63 summarizes the Chain Pharmacy Distributors transactions flagged based on the Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Approach in Trumbull County, regardless of the distributors.

Table 63 Twice Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Trumbull County 2006-2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	0	7,602	0	0	32	721	8,355
HBC Service Company	8,425	26,757	1,939	123	102	5,078	42,424
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	14,922	20,634	1,667	151	678	5,338	43,390
Wal-Mart	721	4,769	62	19	0	855	6,426
Walgreen Co	5,524	3,983	968	0	507	2,603	13,585
Total	29,592	63,745	4,636	293	1,319	14,595	114,180

D. Method 4: Three Times Trailing Twelve-Month Average Pharmacy Dosage Units

1. Lake County Summary

172. Table 64 summarizes the Chain Pharmacy Distributors transactions flagged based on the Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Approach in Lake County, regardless of the distributors.

Table 64 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Lake County 2006-2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	2,178	0	532	0	273	814	3,797
HBC Service Company	1,207	0	161	165	46	900	2,479
Omnicare Distribution	1,532	0	0	73	0	603	2,208
Rite Aid	13,907	0	2,639	519	1,165	3,541	21,771
Wal-Mart	5,904	0	602	282	103	1,318	8,209
Walgreen Co	6,083	0	1,932	0	248	2,239	10,502
Total	30,811	0	5,866	1,039	1,835	9,415	48,966

2. *Trumbull County Summary*

173. Table 65 summarizes the Chain Pharmacy Distributors transactions flagged based on the Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Approach in Trumbull County, regardless of the distributors.

Table 65 Three Times Trailing Twelve-Month Average Pharmacy Dosage Units Threshold Flagged Transactions, Trumbull County 2006-2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	0	1,978	0	0	0	1	1,979
HBC Service Company	0	9,852	0	80	29	1,648	11,609
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	5,684	10,596	156	0	517	1,480	18,433
Wal-Mart	382	0	0	0	0	95	477
Walgreen Co	452	0	0	0	379	1,351	2,182
Total	6,518	22,426	156	80	925	4,575	34,680

E. Method 5: Maximum 8,000 Dosage Units Monthly

1. Lake County Summary

174. Table 66 summarizes the Chain Pharmacy Distributors transactions flagged based on the Maximum 8,000 Dosage Units Monthly Threshold Approach in Lake County, regardless of the distributors.

Table 66 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Lake County 2006-2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	10,049	15,649	0	0	0	0	25,698
HBC Service Company	6,848	20,947	0	0	0	0	27,795
Omnicare Distribution	2,049	528	0	0	0	0	2,577
Rite Aid	16,338	7,769	0	0	0	0	24,107
Wal-Mart	6,739	11,070	0	0	0	0	17,809
Walgreen Co	17,148	18,388	0	0	0	0	35,536
Total	59,171	74,351	0	0	0	0	133,522

2. *Trumbull County Summary*

175. Table 67 summarizes the Chain Pharmacy Distributors transactions flagged based on the Maximum 8,000 Dosage Units Monthly Threshold Approach in Trumbull County, regardless of the distributors.

Table 67 Maximum 8,000 Dosage Units Monthly Threshold Flagged Transactions, Trumbull County 2006-2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	5,986	14,982	0	0	0	0	20,968
HBC Service Company	10,909	51,778	0	0	0	0	62,687
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	18,382	29,243	0	0	0	0	47,625
Wal-Mart	660	12,364	0	0	0	0	13,024
Walgreen Co	14,013	21,615	0	0	0	0	35,628
Total	49,950	129,982	0	0	0	0	179,932

F. Method 6: Maximum Daily Dosage Units

1. Lake County Summary

176. Table 68 summarizes the Chain Pharmacy Distributors transactions flagged based on the Maximum Daily Dosage Units Threshold Approach in Lake County, regardless of the distributors.

Table 68 Maximum Daily Dosage Units Threshold Flagged Transactions, Lake County 2006-2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	11,524	17,315	1,731	383	n/a	1,117	32,070
HBC Service Company	8,702	25,805	723	296	n/a	8	35,534
Omnicare Distribution	1,784	532	1,142	510	n/a	115	4,083
Rite Aid	18,188	10,255	3,170	757	n/a	432	32,802
Wal-Mart	8,163	13,804	1,113	354	n/a	369	23,803
Walgreen Co	17,476	19,406	6,229	1,284	n/a	495	44,890
Total	65,837	87,117	14,108	3,584	n/a	2,536	173,182

2. Trumbull County Summary

177. Table 69 summarizes the Chain Pharmacy Distributors transactions flagged based on the Maximum Daily Dosage Units Threshold Approach in Trumbull County, regardless of the distributors.

Table 69 Maximum Daily Dosage Units Threshold Flagged Transactions, Trumbull County 2006-2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	6,948	15,108	502	59	n/a	431	23,048
HBC Service Company	13,867	52,248	1,678	71	n/a	593	68,457
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	21,757	29,552	3,063	217	n/a	1,022	55,611
Wal-Mart	3,485	13,460	62	19	n/a	228	17,254
Walgreen Co	15,638	21,766	3,676	243	n/a	801	42,124
Total	61,695	132,134	8,981	609	n/a	3,075	206,494

G. Method 7: Maximum Monthly, Trailing Six-month Threshold on Rolling 30-Day Dosage Units Method

1. Lake County Summary

178. Table 70 summarizes the Chain Pharmacy Distributors transactions flagged based on the Maximum Monthly, Trailing Six-month Threshold on Rolling 30-Day Dosage Units method in Lake County, regardless of the distributors.

Table 70 Maximum Monthly, Trailing Six-month Threshold on Rolling 30-Day Dosage Units Flagged Transactions, Lake County 2006-2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	11,628	16,248	1,690	347	325	2,064	32,302
HBC Service Company	9,167	25,838	936	368	0	1,612	37,921
Omnicare Distribution	1,860	446	948	459	0	940	4,653
Rite Aid	17,998	9,701	3,035	720	1,141	3,624	36,219
Wal-Mart	8,348	13,562	1,113	403	80	768	24,274
Walgreen Co	17,030	18,304	6,084	1,307	205	3,219	46,149
Total	66,031	84,099	13,806	3,604	1,751	12,227	181,518

2. Trumbull County Summary

179. Table 71 summarizes the Chain Pharmacy Distributors transactions flagged based on the Maximum Monthly, Trailing Six-month Threshold on Rolling 30-Day Dosage Units method in Trumbull County, regardless of the distributors.

Table 71 Maximum Monthly, Trailing Six-month Threshold on Rolling 30-Day Dosage Units Flagged Transactions, Trumbull County 2006-2014

# of Flagged Transactions	Oxycodone	Hydrocodone	Morphine	Hydromorphone	Oxymorphone	Other	Total
CVS	6,482	14,051	701	59	0	966	22,259
HBC Service Company	13,537	49,494	2,104	92	21	2,911	68,159
Omnicare Distribution	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Rite Aid	21,356	27,723	3,461	119	437	2,012	55,108
Wal-Mart	3,716	12,274	62	0	0	477	16,529
Walgreen Co	15,243	20,674	3,700	22	160	2,585	42,384
Total	60,334	124,216	10,028	292	618	8,951	204,439

IX. Chain Pharmacy Dispensing Data

180. I have received data from CVS, HBC (Giant Eagle), Rite Aid, Walgreens, and Wal-Mart regarding their opioid dispensing activities in Lake and Trumbull Counties, OH. The Dispensing Data is composed of prescriptions, with each line of data containing basic information about the prescriber, the dispensed drug, the dispensed quantity, the dispensing pharmacy and the patient receiving the prescription. I processed the Dispensing Data and appended several columns before I run any analysis (see Appendix 9).

181. In this section, we first summarize the Dispensing Data by opioid drug and by year for Lake County and Trumbull County, OH. Then I compare ARCOS Data reflecting shipments to those chain pharmacies in Lake and Trumbull Counties, OH, with the Dispensing Data, in particular the Dosage Units of oxycodone and hydrocodone dispensed by those pharmacies. I calculate the rolling 365-day total of the ARCOS Data and Dispensing Data.

1. CVS

182. From January 2006 to November 2019, CVS pharmacies in Lake County dispensed 25.5 million Dosage Units of opioids. As shown in Table 72, oxycodone accounted for 51.0% of all Dosage Units and 47.4% of MME in the county. Hydrocodone accounted for 41.1% of all Dosage Units and 21.0% of total MME.

Table 72 CVS Dispensing Data in Lake County by Opioid Drug

Drug Name	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
Oxycodone	186,775	13,007,492	51.0%	159,915,344	47.4%
Hydrocodone	225,621	10,497,738	41.1%	70,615,306	21.0%
Fentanyl	10,402	876	0.0%	41,485,942	12.3%
Morphine	9,888	603,794	2.4%	23,139,905	6.9%
Tapentadol	3,739	265,234	1.0%	8,565,070	2.5%
Oxymorphone	1,974	143,969	0.6%	8,015,280	2.4%
Hydromorphone	3,501	243,845	1.0%	4,045,168	1.2%
Codeine	16	700	0.0%	1,680	0.0%
Methadone	6,846	765,834	3.0%	21,250,845	6.3%
Total	448,762	25,529,482	100.0%	337,034,540	100.0%

183. Table 73 summarizes opioid drugs dispensed by CVS pharmacies in Lake County by year.

Table 73 Opioid Drugs Dispensed by CVS Pharmacies in Lake County by Year

Year	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
2006	24,218	1,076,325	4.2%	12,462,969	3.7%
2007	26,620	1,348,218	5.3%	15,839,331	4.7%
2008	30,649	1,651,824	6.5%	20,324,542	6.0%
2009	33,949	1,951,033	7.6%	25,553,930	7.6%
2010	36,443	2,245,344	8.8%	31,177,726	9.3%
2011	41,081	2,563,206	10.0%	37,261,103	11.1%
2012	44,019	2,771,296	10.9%	39,082,747	11.6%
2013	43,609	2,684,500	10.5%	37,349,010	11.1%
2014	39,779	2,320,521	9.1%	31,298,261	9.3%
2015	33,520	1,859,920	7.3%	24,496,973	7.3%
2016	31,288	1,739,975	6.8%	21,806,741	6.5%
2017	25,077	1,373,429	5.4%	17,346,368	5.1%
2018	21,354	1,100,868	4.3%	13,142,237	3.9%
2019	17,156	843,023	3.3%	9,892,605	2.9%
Total	448,762	25,529,482	100.0%	337,034,540	100.0%

184. From January 2006 to November 2019, CVS pharmacies in Trumbull County dispensed 16.0 million Dosage Units of opioids. As shown in Table 74, oxycodone accounted for 30.2% of all Dosage Units and 41.0% of MME in the county. Hydrocodone accounted for 67.0% of all Dosage Units and 41.6% of total MME.

Table 74 CVS Dispensing Data in Trumbull County by Opioid Drug

Drug Name	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
Hydrocodone	173,258	10,701,691	67.0%	81,761,533	41.6%
Oxycodone	68,415	4,832,952	30.2%	80,547,044	41.0%
Fentanyl	4,494	0	0.0%	16,836,890	8.6%
Morphine	4,529	257,927	1.6%	10,953,930	5.6%
Oxymorphone	475	26,358	0.2%	1,988,175	1.0%
Hydromorphone	505	46,025	0.3%	1,006,392	0.5%
Tapentadol	371	22,990	0.1%	852,300	0.4%
Codeine	3	170	0.0%	408	0.0%
Methadone	655	89,272	0.6%	2,655,945	1.4%
Total	252,705	15,977,385	100.0%	196,602,617	100.0%

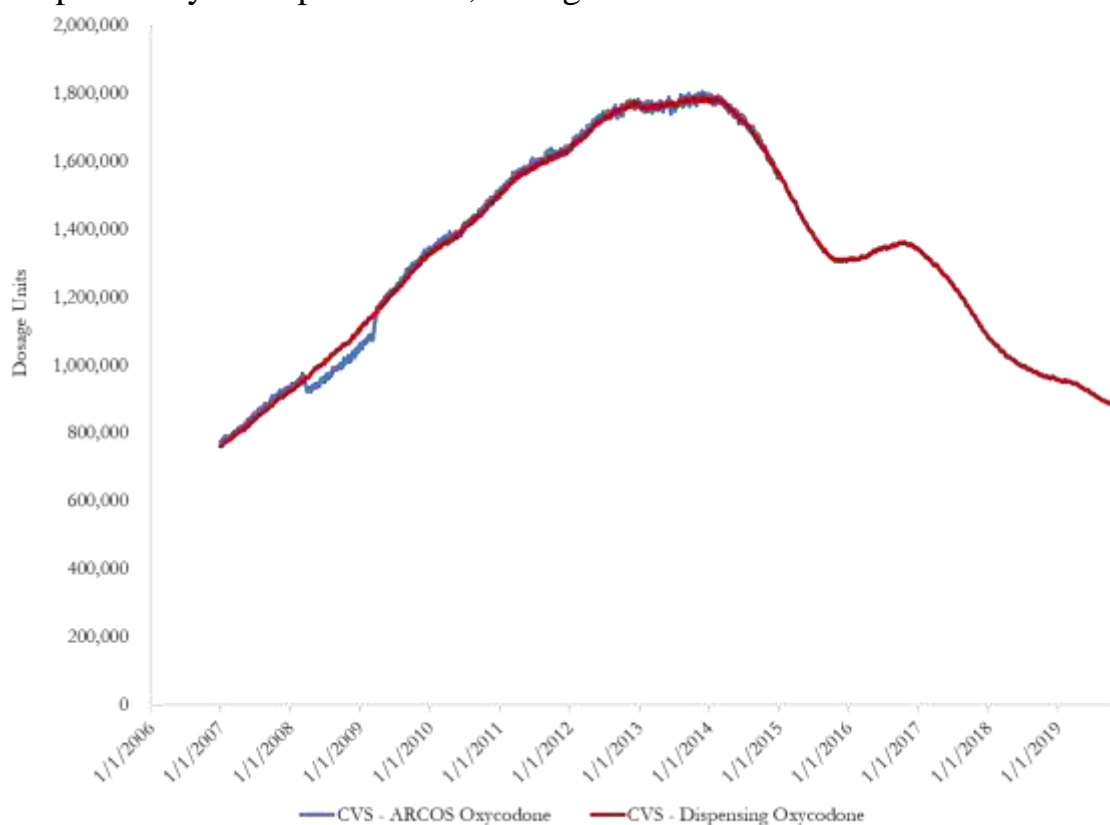
185. Table 75 summarizes opioid drugs dispensed by CVS pharmacies in Trumbull County by year.

Table 75 Opioid Drugs Dispensed by CVS Pharmacies in Trumbull County by Year

Year	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
2006	21,203	1,127,612	7.1%	15,250,919	7.8%
2007	20,151	1,126,745	7.1%	14,331,621	7.3%
2008	20,269	1,213,483	7.6%	15,034,385	7.6%
2009	21,443	1,341,703	8.4%	17,376,602	8.8%
2010	21,609	1,387,001	8.7%	17,458,442	8.9%
2011	21,250	1,357,407	8.5%	16,045,079	8.2%
2012	20,843	1,325,833	8.3%	14,677,112	7.5%
2013	19,855	1,286,778	8.1%	14,264,630	7.3%
2014	18,864	1,233,498	7.7%	14,492,093	7.4%
2015	15,186	1,044,419	6.5%	13,040,555	6.6%
2016	15,211	1,063,885	6.7%	13,888,099	7.1%
2017	12,696	892,393	5.6%	11,221,624	5.7%
2018	12,689	844,513	5.3%	10,614,065	5.4%
2019	11,436	732,115	4.6%	8,907,393	4.5%
Total	252,705	15,977,385	100.0%	196,602,617	100.0%

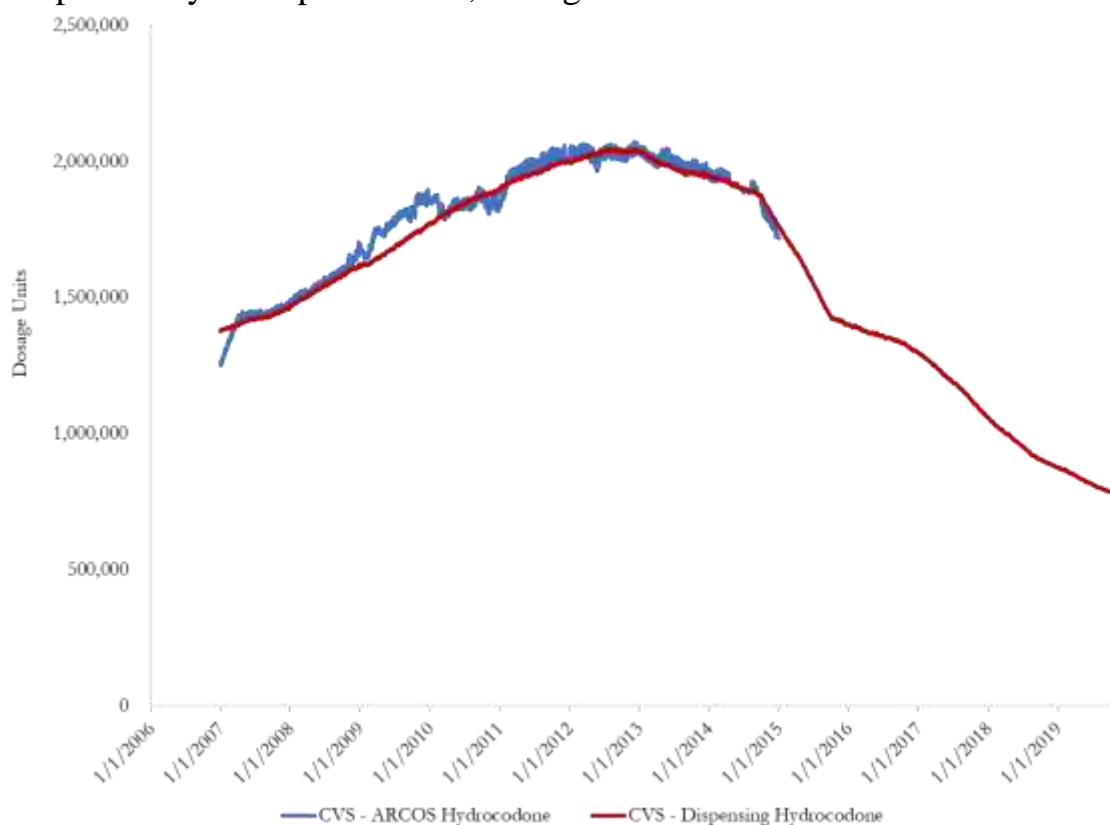
186. Figure 26 shows the rolling 365-day oxycodone shipment into CVS pharmacies (from January 2007 to December 2014) and oxycodone dispensed by the same pharmacies (from January 2007 to November 2019).

Figure 26 Rolling 365-day Oxycodone Shipment into and Oxycodone Dispensed by CVS pharmacies, Dosage Units



187. Figure 27 shows the rolling 365-day hydrocodone shipment into CVS pharmacies (from January 2007 to December 2014) and hydrocodone dispensed by the same pharmacies (from January 2007 to November 2019).

Figure 27 Rolling 365-day Hydrocodone Shipment into and Hydrocodone Dispensed by CVS pharmacies, Dosage Units



2. HBC Service Company

188. From January 2006 to December 2019, HBC pharmacies in Lake County dispensed 16.8 million Dosage Units of opioids. As shown in Table 76, oxycodone accounted for 45.9% of all Dosage Units and 46.5% of MME in the county. Hydrocodone accounted for 48.5% of all Dosage Units and 30.5% of total MME.

Table 76 HBC Dispensing Data in Lake County by Opioid Drug

Drug Name	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
Oxycodone	123,234	7,701,372	45.9%	80,833,376	46.5%
Hydrocodone	185,641	8,140,928	48.5%	52,990,161	30.5%
Fentanyl	3,802	3,024	0.0%	13,940,830	8.0%
Morphine	5,340	325,665	1.9%	8,796,603	5.1%
Tapentadol	2,008	135,714	0.8%	4,242,320	2.4%
Hydromorphone	2,027	135,888	0.8%	2,688,760	1.5%
Oxymorphone	830	58,672	0.3%	2,527,080	1.5%
Codeine	16	1,110	0.0%	2,664	0.0%
Methadone	2,915	285,558	1.7%	7,820,220	4.5%
Total	325,813	16,787,931	100.0%	173,842,013	100.0%

189. Table 77 summarizes opioid drugs dispensed by HBC pharmacies in Lake County by year.

Table 77 Opioid Drugs Dispensed by HBC Pharmacies in Lake County by Year

Year	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
2006	15,392	659,156	3.9%	7,610,008	4.4%
2007	18,326	799,461	4.8%	7,993,759	4.6%
2008	22,524	1,057,667	6.3%	10,121,118	5.8%
2009	24,493	1,207,365	7.2%	11,795,012	6.8%
2010	26,539	1,312,146	7.8%	13,271,553	7.6%
2011	31,175	1,573,432	9.4%	16,141,609	9.3%
2012	32,703	1,687,950	10.1%	17,408,853	10.0%
2013	30,715	1,622,231	9.7%	16,725,425	9.6%
2014	27,856	1,447,783	8.6%	14,802,302	8.5%
2015	25,739	1,397,584	8.3%	14,779,539	8.5%
2016	22,796	1,276,122	7.6%	13,902,405	8.0%
2017	18,830	1,077,353	6.4%	11,890,295	6.8%
2018	15,791	903,035	5.4%	9,401,712	5.4%
2019	12,934	766,646	4.6%	7,998,424	4.6%
Total	325,813	16,787,931	100.0%	173,842,013	100.0%

190. From January 2006 to December 2019, HBC pharmacies in Trumbull County dispensed 27.3 million Dosage Units of opioids. As shown in Table 78, oxycodone accounted for 28.7% of all Dosage Units and 37.7% of MME in the county. Hydrocodone accounted for 68.1% of all Dosage Units and 41.5% of total MME.

Table 78 HBC Dispensing Data in Trumbull County by Opioid Drug

Drug Name	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
Hydrocodone	315,401	18,580,268	68.1%	137,645,131	41.5%
Oxycodone	110,700	7,833,592	28.7%	125,136,160	37.7%
Fentanyl	9,399	140	0.0%	35,778,744	10.8%
Morphine	8,337	491,501	1.8%	20,690,665	6.2%
Tapentadol	1,412	85,335	0.3%	3,375,750	1.0%
Oxymorphone	741	42,746	0.2%	2,169,323	0.7%
Hydromorphone	1,303	101,769	0.4%	1,597,008	0.5%
Codeine	66	2,815	0.0%	6,756	0.0%
Methadone	1,518	158,838	0.6%	5,620,110	1.7%
Total	448,877	27,297,004	100.0%	332,019,647	100.0%

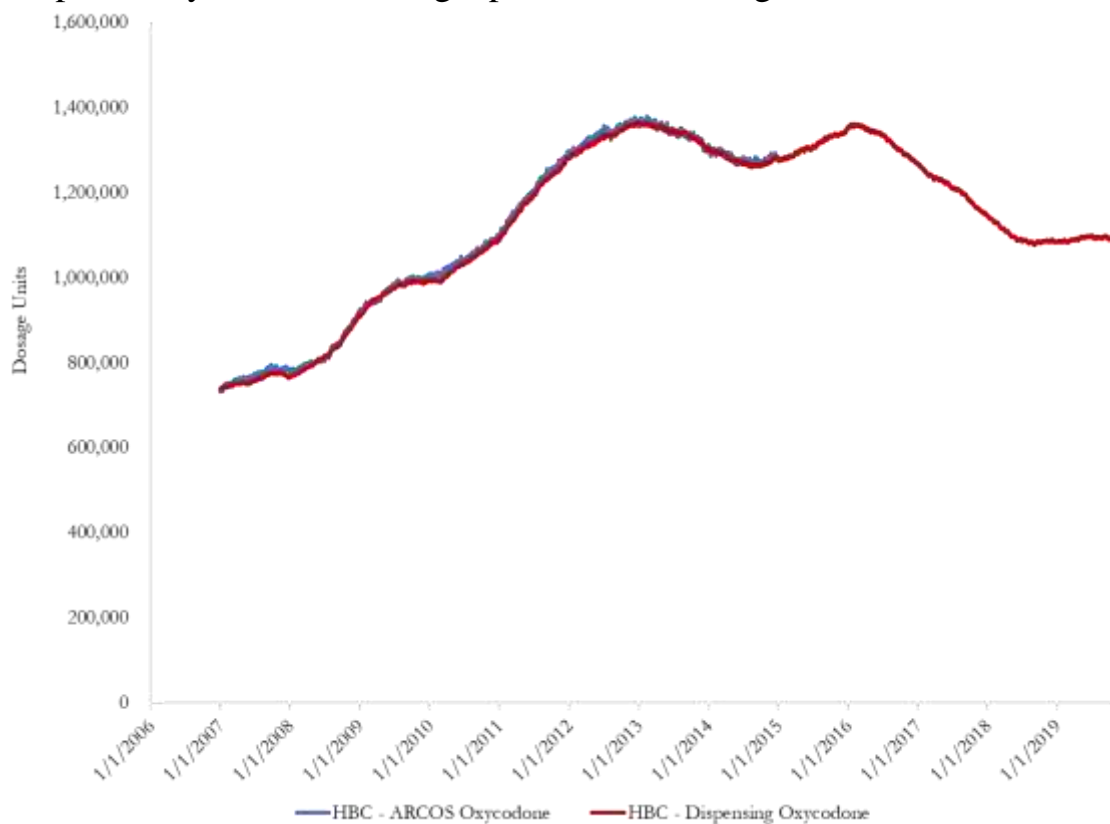
191. Table 79 summarizes opioid drugs dispensed by HBC pharmacies in Trumbull County by year.

Table 79 Opioid Drugs Dispensed by HBC Pharmacies in Trumbull County by Year

Year	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
2006	33,224	1,825,518	6.7%	25,550,010	7.7%
2007	34,692	1,928,571	7.1%	25,435,153	7.7%
2008	36,432	2,097,295	7.7%	26,675,181	8.0%
2009	37,128	2,167,662	7.9%	26,081,189	7.9%
2010	39,149	2,305,377	8.4%	27,502,527	8.3%
2011	41,118	2,467,933	9.0%	29,241,968	8.8%
2012	41,659	2,535,977	9.3%	29,612,896	8.9%
2013	37,840	2,350,953	8.6%	27,169,265	8.2%
2014	34,033	2,189,783	8.0%	25,764,476	7.8%
2015	28,237	1,855,674	6.8%	22,766,088	6.9%
2016	25,172	1,660,772	6.1%	19,638,727	5.9%
2017	21,751	1,432,630	5.2%	16,902,141	5.1%
2018	20,528	1,327,325	4.9%	16,097,931	4.8%
2019	17,914	1,151,534	4.2%	13,582,095	4.1%
Total	448,877	27,297,004	100.0%	332,019,647	100.0%

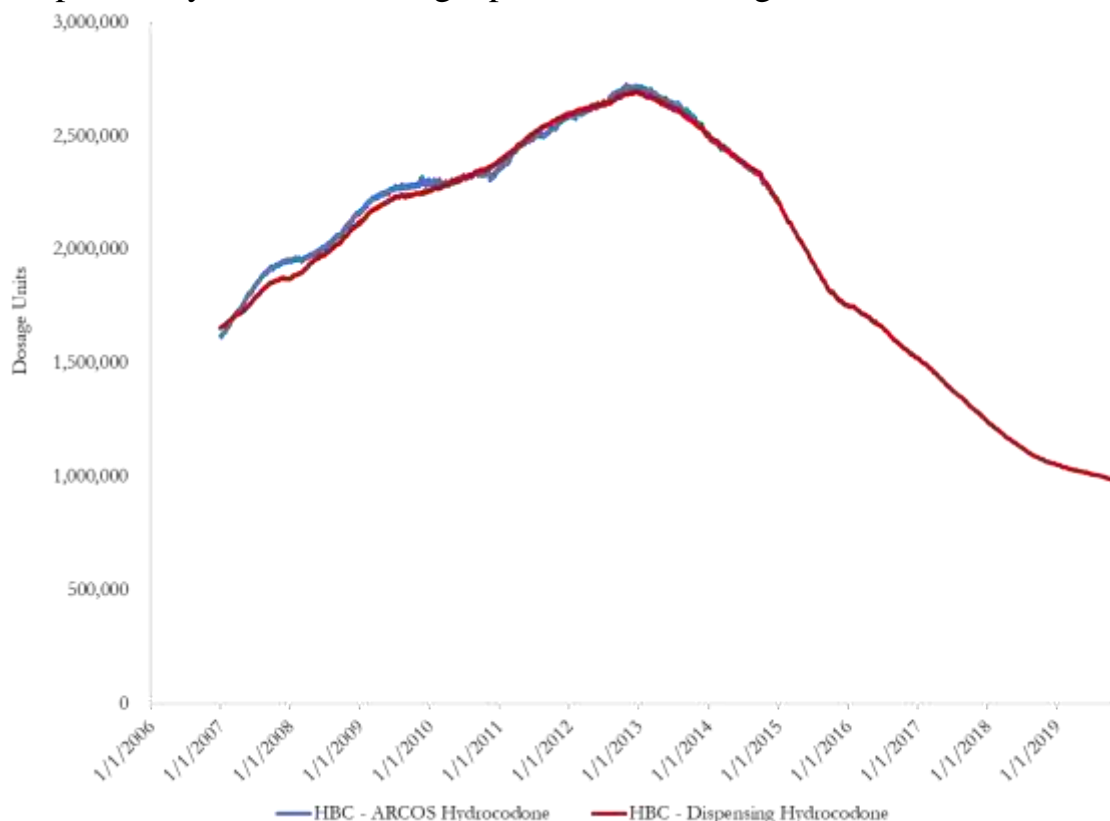
192. Figure 28 shows the rolling 365-day oxycodone shipment into HBC/Giant Eagle pharmacies (from January 2007 to December 2014) and oxycodone dispensed by the same pharmacies (from January 2007 to November 2019).

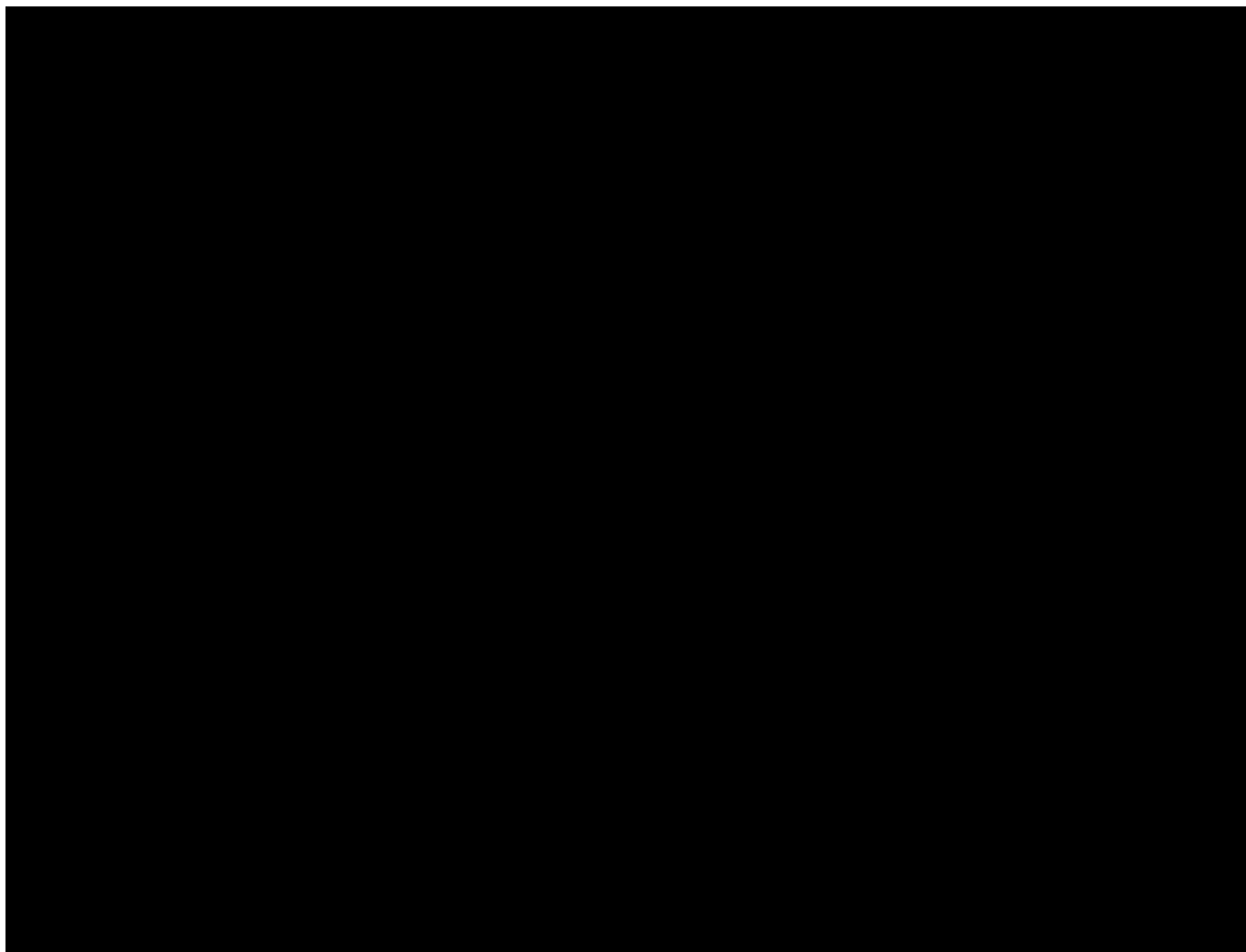
Figure 28 Rolling 365-day Oxycodone Shipment into and Oxycodone Dispensed by HBC/Giant Eagle pharmacies, Dosage Units

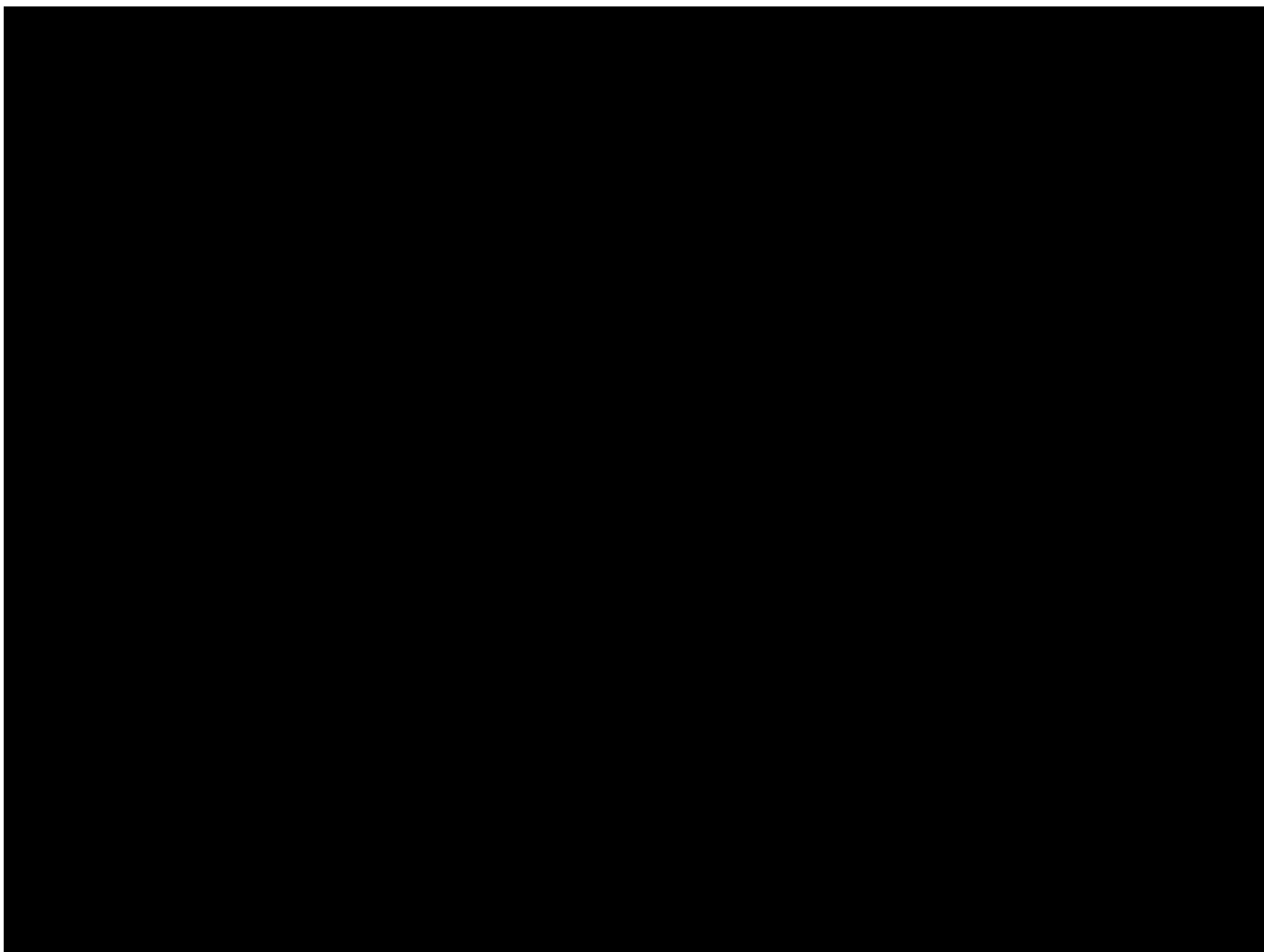


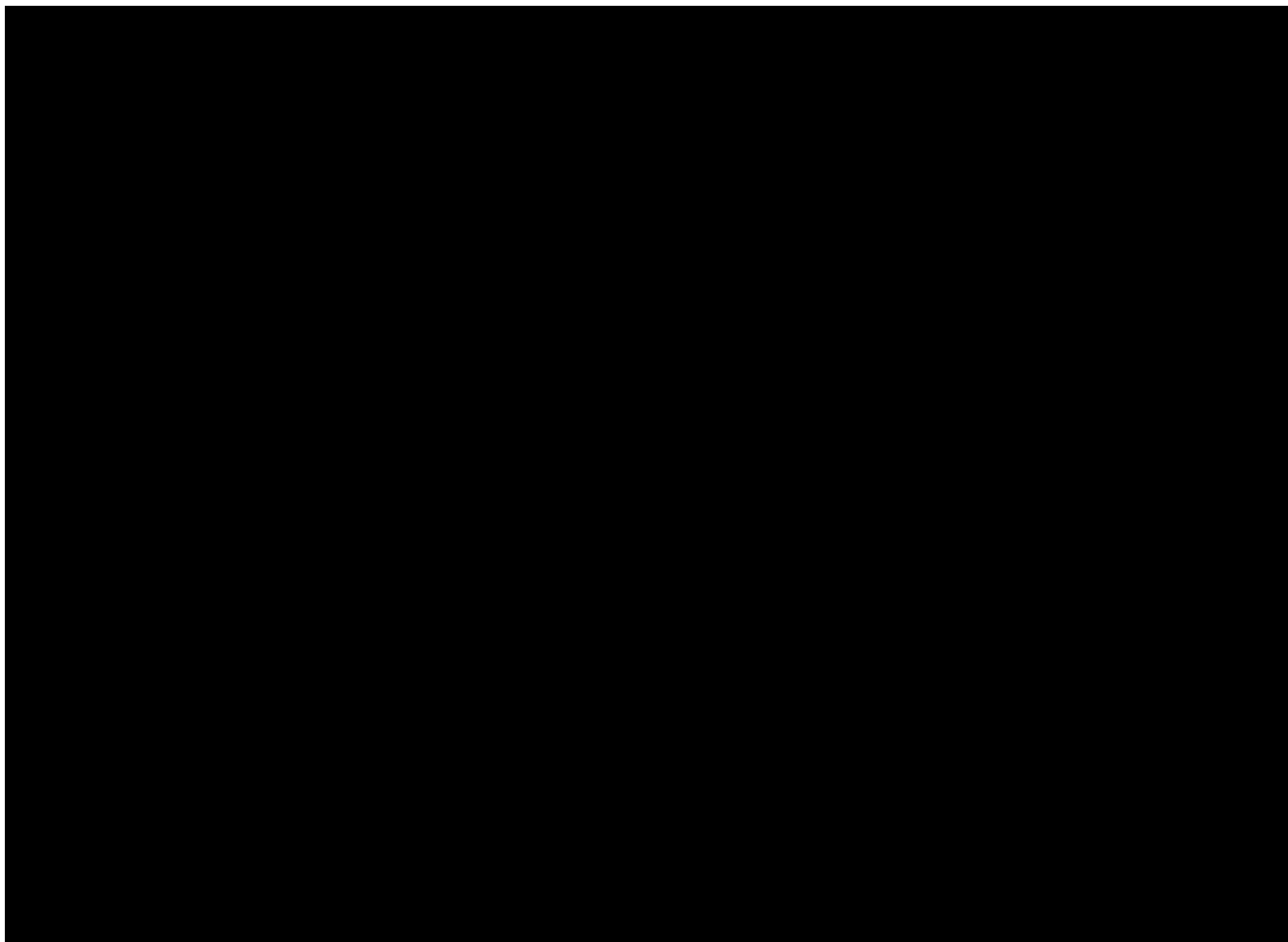
193. Figure 29 shows the rolling 365-day hydrocodone shipment into HBC/Giant Eagle pharmacies (from January 2007 to December 2014) and hydrocodone dispensed by the same pharmacies (from January 2007 to November 2019).

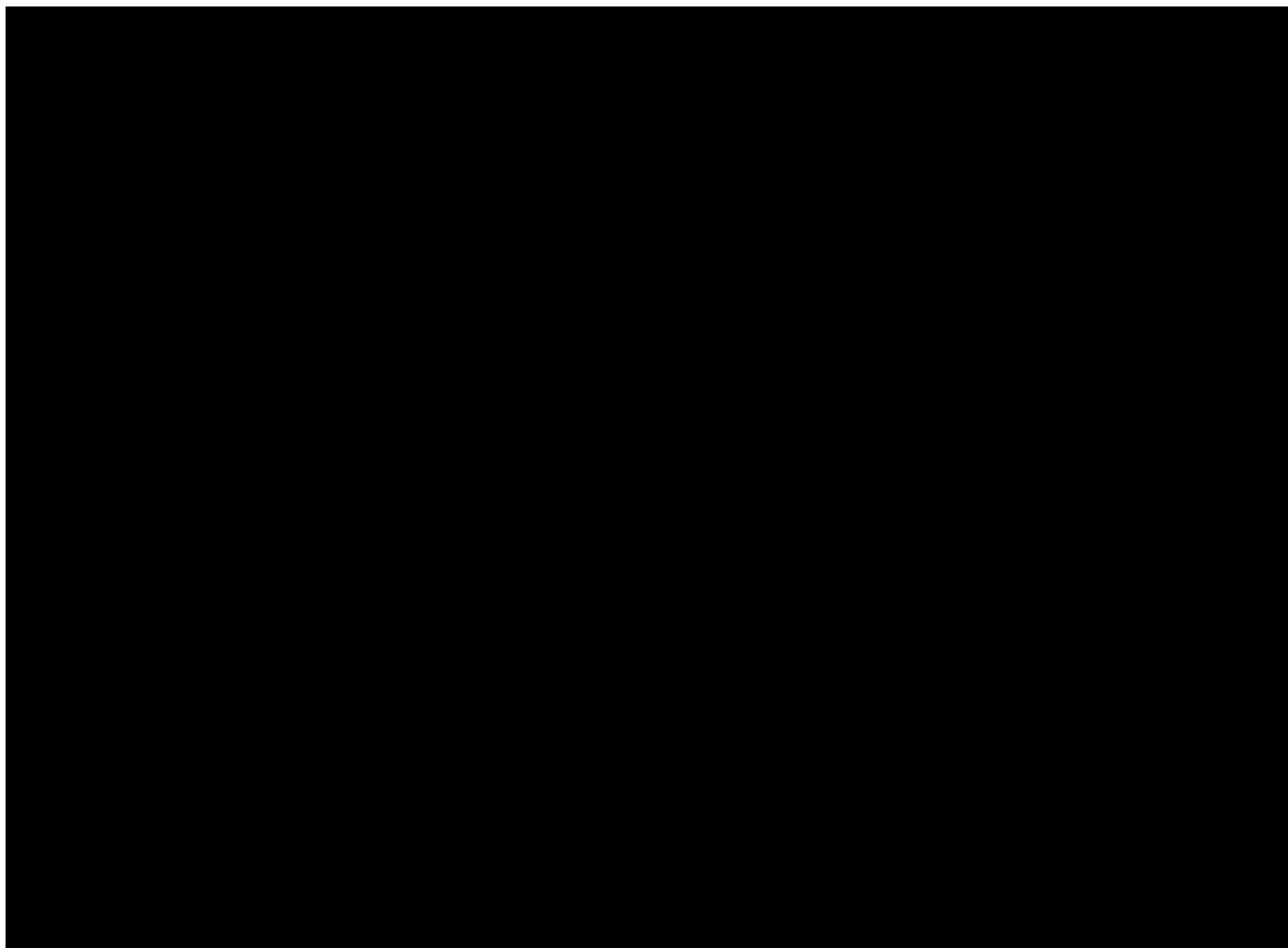
Figure 29 Rolling 365-day Hydrocodone Shipment into and Hydrocodone Dispensed by HBC/Giant Eagle pharmacies, Dosage Units

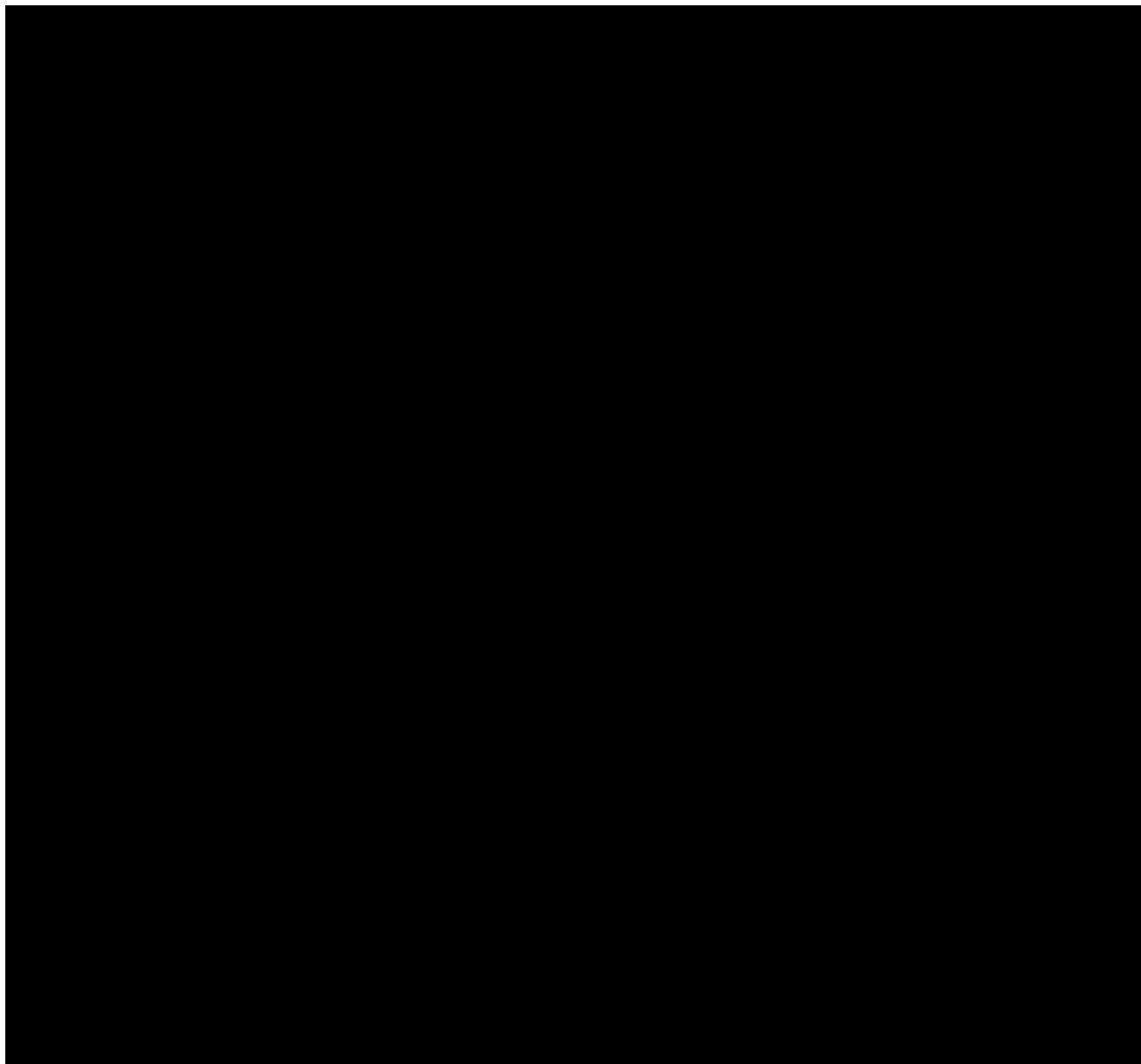


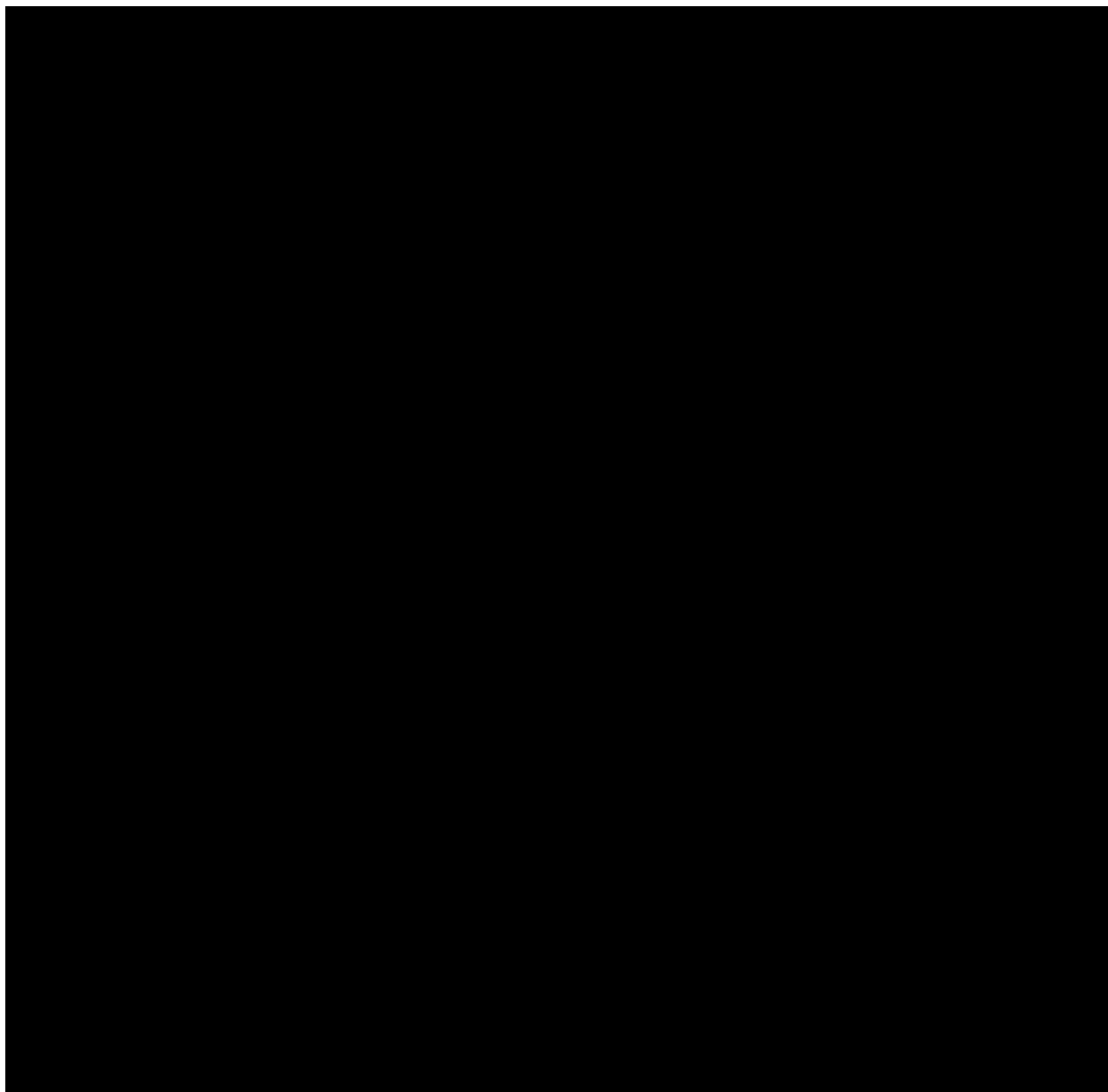












4. Walgreens

200. From January 2006 to January 2020, Walgreens pharmacies in Lake County dispensed 25.4 million Dosage Units of opioids. As shown in Table 84, oxycodone accounted for 51.5% of all Dosage Units and 46.7% of MME in the county. Hydrocodone accounted for 36.0% of all Dosage Units and 16.9% of total MME.

Table 84 Walgreens Dispensing Data in Lake County by Opioid Drug

Drug Name	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
Oxycodone	179,181	13,055,332	51.5%	169,159,966	46.7%
Hydrocodone	191,136	9,118,612	36.0%	61,272,872	16.9%
Morphine	19,424	1,234,864	4.9%	45,123,886	12.5%
Fentanyl	8,843	17,106	0.1%	33,778,244	9.3%
Hydromorphone	4,886	368,468	1.5%	6,322,216	1.7%
Tapentadol	2,373	172,146	0.7%	5,289,890	1.5%
Oxymorphone	1,393	102,888	0.4%	4,800,420	1.3%
Codeine	88	8,780	0.0%	21,072	0.0%
Methadone	11,496	1,276,653	5.0%	36,428,280	10.1%
Total	418,820	25,354,849	100.0%	362,196,846	100.0%

201. Table 85 summarizes opioid drugs dispensed by Walgreens pharmacies in Lake County by year.

Table 85 Opioid Drugs Dispensed by Walgreens Pharmacies in Lake County by Year

Year	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
2006	13,723	716,105	2.8%	11,943,429	3.3%
2007	33,625	1,815,829	7.2%	30,602,165	8.4%
2008	34,608	2,014,407	7.9%	33,345,713	9.2%
2009	36,996	2,259,502	8.9%	35,575,179	9.8%
2010	38,946	2,485,372	9.8%	37,463,793	10.3%
2011	40,180	2,548,655	10.1%	38,002,437	10.5%
2012	32,736	2,083,164	8.2%	30,269,489	8.4%
2013	30,416	1,828,289	7.2%	25,409,092	7.0%
2014	30,814	1,786,754	7.0%	23,095,819	6.4%
2015	31,892	1,906,169	7.5%	23,891,199	6.6%
2016	31,016	1,933,753	7.6%	24,238,536	6.7%
2017	25,802	1,631,721	6.4%	19,979,836	5.5%
2018	20,470	1,258,439	5.0%	15,511,753	4.3%
2019	17,596	1,086,690	4.3%	12,868,404	3.6%
2020	0	0	0.0%	0	0.0%
Total	418,820	25,354,849	100.0%	362,196,846	100.0%

202. From January 2006 to January 2020, Walgreens pharmacies in Trumbull County dispensed 28.0 million Dosage Units of opioids. As shown in Table 86, oxycodone accounted for 39.3% of all Dosage Units and 51.4% of MME in the county. Hydrocodone accounted for 54.1% of all Dosage Units and 26.1% of total MME.

Table 86 Walgreens Dispensing Data in Trumbull County by Opioid Drug

Drug Name	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
Oxycodone	135,846	11,000,425	39.3%	235,719,220	51.4%
Hydrocodone	222,198	15,130,291	54.1%	119,641,083	26.1%
Morphine	12,582	746,866	2.7%	34,388,300	7.5%
Fentanyl	7,740	9,815	0.0%	32,076,886	7.0%
Oxymorphone	1,947	106,904	0.4%	7,907,730	1.7%
Hydromorphone	1,548	121,661	0.4%	2,233,240	0.5%
Tapentadol	961	69,025	0.2%	2,226,560	0.5%
Codeine	1	12	0.0%	29	0.0%
Methadone	4,550	784,599	2.8%	24,296,244	5.3%
Total	387,373	27,969,598	100.0%	458,489,292	100.0%

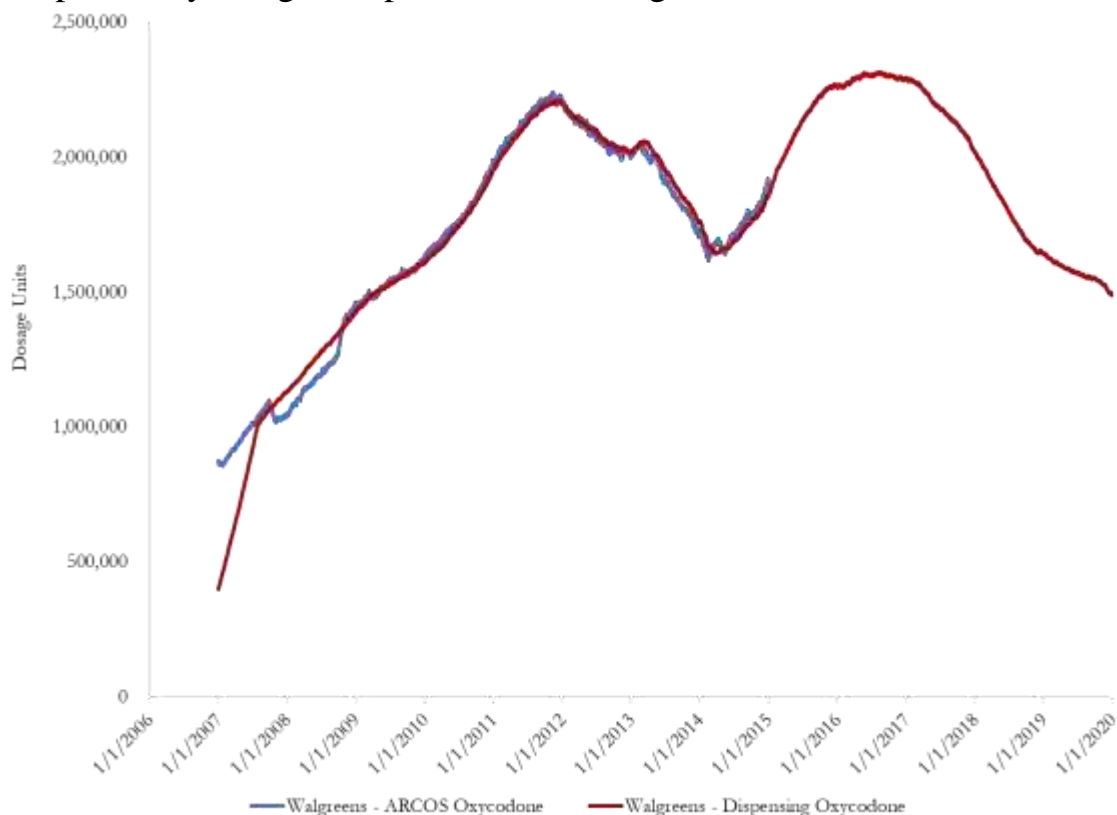
203. Table 87 summarizes opioid drugs dispensed by Walgreens pharmacies in Trumbull County by year.

Table 87 Opioid Drugs Dispensed by Walgreens Pharmacies in Trumbull County by Year

Year	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
2006	5,669	343,810	1.2%	4,861,501	1.1%
2007	16,427	1,000,731	3.6%	17,543,443	3.8%
2008	22,578	1,516,593	5.4%	29,636,624	6.5%
2009	26,655	1,878,016	6.7%	32,163,899	7.0%
2010	30,949	2,195,979	7.9%	40,270,701	8.8%
2011	34,037	2,489,556	8.9%	47,698,347	10.4%
2012	31,856	2,322,142	8.3%	44,411,530	9.7%
2013	32,495	2,302,384	8.2%	37,787,509	8.2%
2014	33,080	2,398,261	8.6%	36,373,321	7.9%
2015	37,661	2,861,408	10.2%	42,283,325	9.2%
2016	35,708	2,685,604	9.6%	39,598,146	8.6%
2017	30,657	2,349,660	8.4%	34,041,261	7.4%
2018	26,042	1,943,414	6.9%	28,098,331	6.1%
2019	23,558	1,681,995	6.0%	23,721,018	5.2%
2020	1	45	0.0%	338	0.0%
Total	387,373	27,969,598	100.0%	458,489,292	100.0%

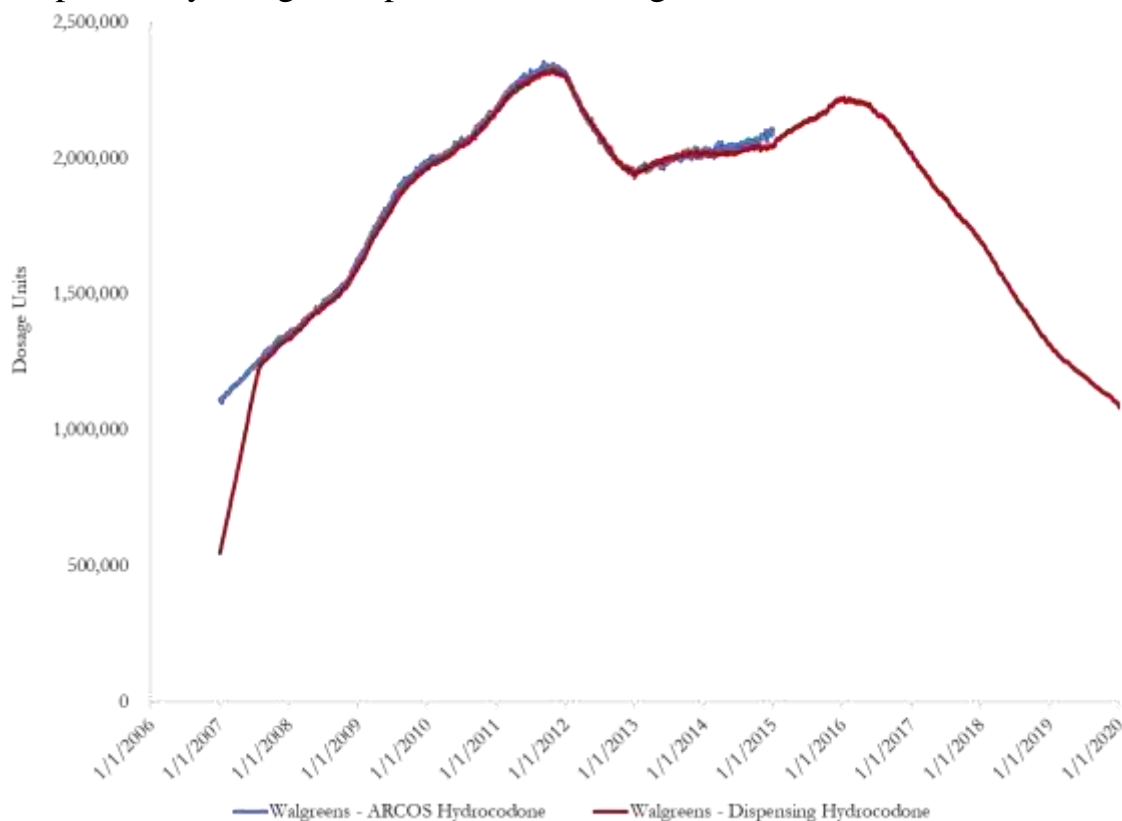
204. Figure 32 shows the rolling 365-day oxycodone shipment into Walgreens pharmacies (from January 2007 to December 2014) and oxycodone dispensed by the same pharmacies (from January 2007 to December 2019).

Figure 32 Rolling 365-day Oxycodone Shipment into and Oxycodone Dispensed by Walgreens pharmacies, Dosage Units



205. Figure 33 shows the rolling 365-day hydrocodone shipment into Walgreens pharmacies (from January 2007 to December 2014) and hydrocodone dispensed by the same pharmacies (from January 2007 to to January 2020).

Figure 33 Rolling 365-day Hydrocodone Shipment into and Hydrocodone Dispensed by Walgreens pharmacies, Dosage Units



5. *Wal-Mart*

206. From January 2006 to April 2018, Wal-Mart pharmacies in Lake County dispensed 9.9 million Dosage Units of opioids.⁴³ As shown in Table 88, oxycodone accounted for 52.7% of all Dosage Units and 51.9% of MME in the county. Hydrocodone accounted for 38.6% of all Dosage Units and 19.5% of total MME.

Table 88 Wal-Mart Dispensing Data in Lake County by Opioid Drug

Drug Name	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
Oxycodone	64,476	5,210,503	52.7%	66,761,913	51.9%
Hydrocodone	73,634	3,813,525	38.6%	25,128,681	19.5%
Morphine	4,549	279,441	2.8%	10,382,740	8.1%
Fentanyl	3,000	0	0.0%	10,328,484	8.0%
Hydromorphone	1,521	126,334	1.3%	2,090,048	1.6%
Oxymorphone	357	23,274	0.2%	1,280,190	1.0%
Tapentadol	660	37,110	0.4%	1,214,270	0.9%
Codeine	0	0	0.0%	0	0.0%
Methadone	3,736	400,584	4.1%	11,426,775	8.9%
Total	151,933	9,890,771	100.0%	128,613,101	100.0%

⁴³ We received the dispensing data of 5 Wal-Mart pharmacies in Lake and Trumbull Counties, not the dispensing data of Sam's Club.

207. Table 89 summarizes opioid drugs dispensed by Wal-Mart pharmacies in Lake County by year.

Table 89 Opioid Drugs Dispensed by Wal-Mart Pharmacies in Lake County by Year

Year	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
2006	7,123	401,841	4.1%	5,756,348	4.5%
2007	9,624	546,231	5.5%	6,871,808	5.3%
2008	11,660	714,690	7.2%	8,677,968	6.7%
2009	13,621	877,068	8.9%	11,001,894	8.6%
2010	14,501	959,294	9.7%	12,443,119	9.7%
2011	15,598	1,042,078	10.5%	14,192,882	11.0%
2012	14,630	966,849	9.8%	13,613,638	10.6%
2013	14,502	993,284	10.0%	13,106,654	10.2%
2014	13,749	926,815	9.4%	11,931,186	9.3%
2015	12,384	834,869	8.4%	10,952,512	8.5%
2016	11,699	782,260	7.9%	9,919,567	7.7%
2017	10,050	658,435	6.7%	7,996,114	6.2%
2018	2,792	187,057	1.9%	2,149,413	1.7%
Total	151,933	9,890,771	100.0%	128,613,101	100.0%

208. From January 2006 to April 2018, Wal-Mart pharmacies in Trumbull County dispensed 5.2 million Dosage Units of opioids. As shown in Table 90, oxycodone accounted for 31.3% of all Dosage Units and 38.9% of MME in the county. Hydrocodone accounted for 66.1% of all Dosage Units and 46.8% of total MME.

Table 90 Wal-Mart Dispensing Data in Trumbull County by Opioid Drug

Drug Name	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
Hydrocodone	53,541	3,457,264	66.1%	26,327,379	46.8%
Oxycodone	21,106	1,636,754	31.3%	21,876,172	38.9%
Fentanyl	1,016	0	0.0%	3,489,134	6.2%
Morphine	866	48,707	0.9%	1,883,055	3.4%
Oxymorphone	70	3,987	0.1%	242,670	0.4%
Tapentadol	97	5,802	0.1%	191,130	0.3%
Hydromorphone	79	4,482	0.1%	58,464	0.1%
Codeine	0	0	0.0%	0	0.0%
Methadone	298	71,492	1.4%	2,134,965	3.8%
Total	77,073	5,228,488	100.0%	56,202,969	100.0%

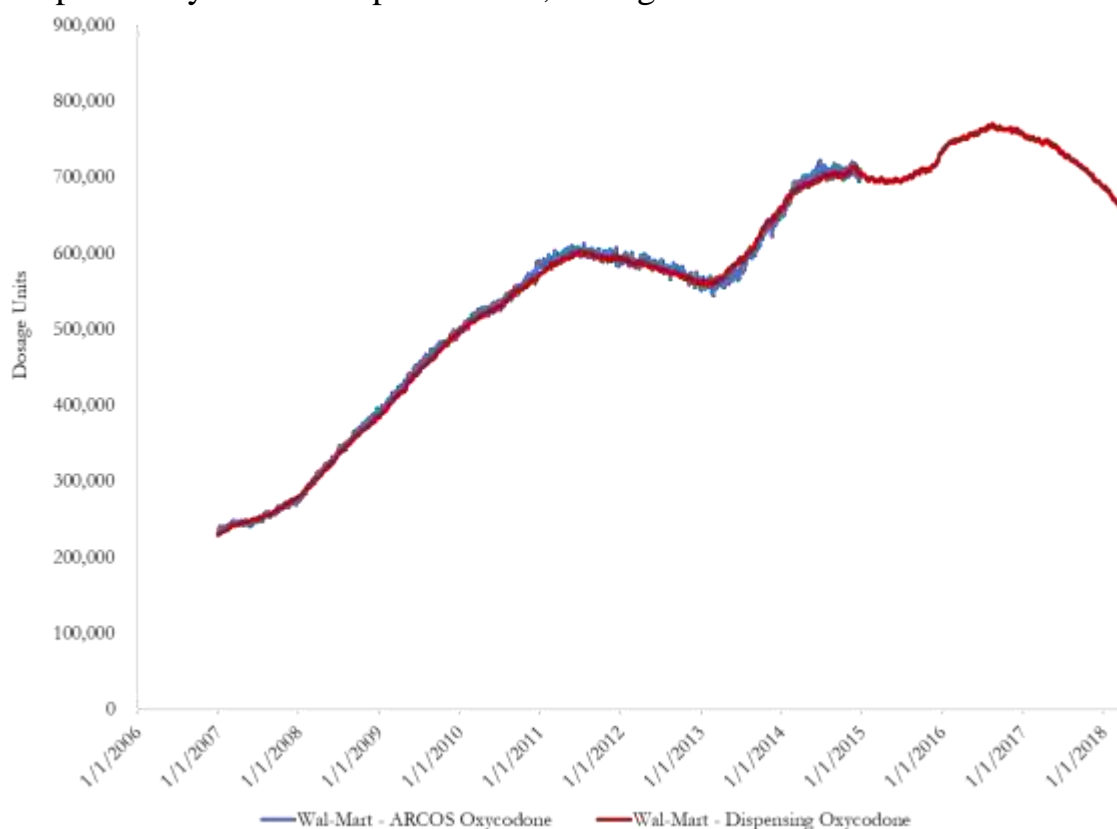
209. Table 91 summarizes opioid drugs dispensed by Wal-Mart pharmacies in Trumbull County by year.

Table 91 Opioid Drugs Dispensed by Wal-Mart Pharmacies in Trumbull County by Year

Year	# of Prescriptions	Dosage Units	Dosage Units %	MME	MME %
2006	3,332	194,958	3.7%	2,268,838	4.0%
2007	3,876	229,104	4.4%	2,462,047	4.4%
2008	4,225	257,052	4.9%	2,478,656	4.4%
2009	4,885	294,645	5.6%	2,740,711	4.9%
2010	6,367	392,436	7.5%	3,904,172	6.9%
2011	6,415	389,554	7.5%	3,695,983	6.6%
2012	6,481	385,813	7.4%	3,885,742	6.9%
2013	6,783	439,192	8.4%	5,060,762	9.0%
2014	7,544	541,839	10.4%	5,903,427	10.5%
2015	8,491	649,464	12.4%	7,325,326	13.0%
2016	9,173	717,223	13.7%	8,087,933	14.4%
2017	7,625	600,392	11.5%	6,844,027	12.2%
2018	1,876	136,816	2.6%	1,545,345	2.7%
Total	77,073	5,228,488	100.0%	56,202,969	100.0%

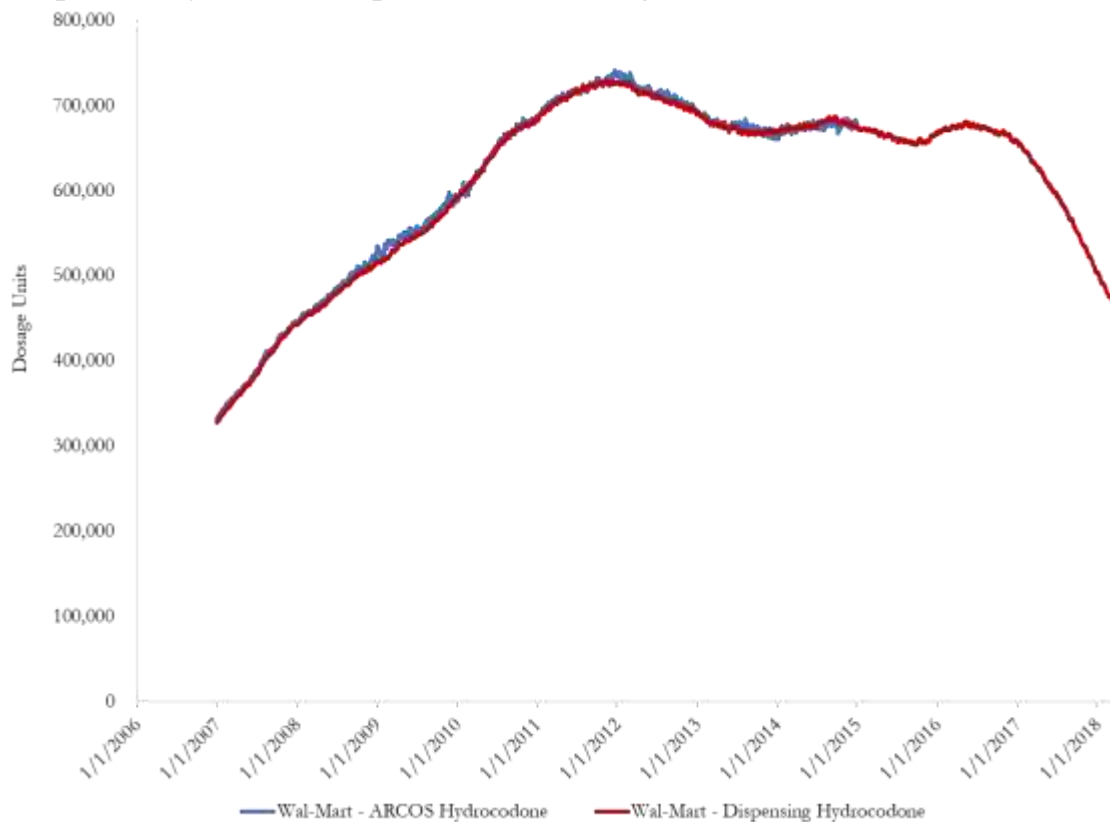
210. Figure 34 shows the rolling 365-day oxycodone shipment into Wal-Mart pharmacies (from January 2007 to December 2014) and oxycodone dispensed by the same pharmacies (from January 2007 to April 2018). Wal-Mart as a distributor distributed to both Wal-Mart pharmacies and Sam's Clubs, but the comparison here involves the shipment to the Wal-Mart pharmacies in Lake and Trumbull Counties only.

Figure 34 Rolling 365-day Oxycodone Shipment into and Oxycodone Dispensed by Wal-Mart pharmacies, Dosage Units



211. Figure 35 shows the rolling 365-day hydrocodone shipment into Wal-Mart pharmacies (from January 2007 to December 2014) and hydrocodone dispensed by the same pharmacies (from January 2007 to April 2018).

Figure 35 Rolling 365-day Hydrocodone Shipment into and Hydrocodone Dispensed by Wal-Mart pharmacies, Dosage Units



X. Red Flags on Dispensing Data

A. 43 Red Flags

212. I have been asked to apply non-exhaustive set of algorithms to identify prescriptions meeting specified criteria using the Dispensing Data.⁴⁴ I calculated the results separately for each of the methodologies described below.⁴⁵ For Methods 17-36 and 38-43, I was asked to identify sets of prescriptions that meet certain criteria and to flag prescriptions dispensed within 30 minutes of the first dispensed prescription which casued the set of prescriptions that meet each criteria.⁴⁶

- 1) An opioid was dispensed to a patient who traveled more than 25 miles to visit the pharmacy. The distance here is calculated from the center of the patient's zip code to the center of the pharmacy's zip code. [P]

⁴⁴ It is my understanding that each of the prescription flagging criteria, or each sub-part of the criteria, can be found in or is supported by documents produced by the defendants (including but not limited to defendant's policies, procedures and training materials), DEA guidance and decisions, court decisions, guidance from State Boards of Pharmacy, negotiated consensus documents published by the National Association of the Boards of Pharmacy, and/or by industry trade groups such as the National Association of Chain Drug Stores, medical literature, testimony in In Re: National Prescription Opiate Litigation, Case No. 18-md-2804 (MDL), and/or the Expert Report of Carmen Catizone. A non-exhaustive list of examples such support can be found at Appendix 12.

⁴⁵ The de-identified patient code cannot be viewed or compared across all Defendant Data.

⁴⁶ I report the results of the 43 algorithms two ways. First, I report only the specific dispensed prescriptions or sets of dispensed prescriptions identified by the algorithm. I also report the specific dispensed prescriptions or sets of dispensed prescriptions identified by the algorithm and any opioid prescription thereafter either dispensed to the patient denoted with a "P" or written by the prescriber denoted with a "D".

- 2) An opioid was dispensed to a patient who traveled more than 25 miles to visit their prescriber. The distance here is calculated from the center of the patient's zip code to the center of prescriber's zip code. [P, D]
- 3) Patient was dispensed opioid prescriptions with overlapping days of supply that were written by two or more prescribers. [P]
- 4) Patient was dispensed opioid prescriptions with overlapping days of supply at two or more pharmacies. [P]
- 5) Patient was dispensed an opioid, a benzodiazepine and a muscle relaxer for overlapping days of supply. [P]
- 6) Patient was dispensed an opioid, a benzodiazepine and a muscle relaxer on the same day and all the prescriptions were written by the same prescriber. [P, D]
- 7) Patient was dispensed an opioid and a benzodiazepine within 30 days of one another. [P]
- 8) Patient was dispensed an opioid and a benzodiazepine on the same day and both prescriptions were written by the same prescriber. [P, D]
- 9) Patient was dispensed two short acting opioid drugs on the same day. [P]
- 10) Patient was dispensed an opioid prescription of over 200 MME per day before 2018 or over 50 MME per day after January 1, 2018. [P, D]
- 11) Patient was dispensed an opioid prescription of over 200 MME per day before 2018 or over 90 MME per day after January 1, 2018. [P, D]

- 12) An opioid was dispensed to at least 4 different patients on the same day and the opioid prescriptions were for the same base drug, strength and dosage form and were written by the same prescriber. [P, D]
- 13) An opioid was dispensed to at least 3 different patients within an hour and the opioid prescriptions were for the same base drug, strength and dosage form and were written by the same prescriber. [P, D]
- 14) An opioid prescription was refilled more than 5 days before the patient's previous prescription should have run out. [P]
- 15) A patient was dispensed more than 210 "days of supply" of all opioids combined in a 6-month period. [P]
- 16) A patient was dispensed an opioid and paid cash. [P]
- 17) A patient was dispensed an opioid prescription written by a prescriber located more than 25 miles from the patient **and** the patient was also dispensed either (i) at least 1 other opioid prescription written by the same prescriber on a different day within 30 days of the original opioid prescription or (ii) a benzodiazepine or muscle relaxer prescription written by the same prescriber on the same day as the original opioid prescription was written. [P, D]
- 18) A patient was dispensed opioid prescriptions written by at least 2 different prescribers such that all the opioid prescriptions were written in a 20-day period and at least one of the prescribers is located more than 25 miles from the patient. [P]
- 19) A patient was dispensed opioid prescriptions written by at least 3 different prescribers such that all the opioid prescriptions were written

in a 45-day period and at least one of the prescribers is located more than 25 miles from the patient. [P]

- 20) A patient was dispensed opioid prescriptions written by at least 3 different prescribers such that all the opioid prescriptions were written in a 45-day period. [P]
- 21) A patient was dispensed opioid prescriptions written by at least 3 different prescribers such that all the opioid prescriptions were written in a 60-day period and these prescribers are located in at least 3 different zip codes. [P]
- 22) A patient was dispensed opioid prescriptions by at least 2 different pharmacies such that all the opioid prescriptions were dispensed in a 20-day period and at least one of the pharmacies is located more than 25 miles from the patient. [P]
- 23) A patient was dispensed at least 3 opioid prescriptions by at least 2 different pharmacies such that all the opioid prescriptions were dispensed in a 45-day period and at least one of the pharmacies is located more than 25 miles from the patient. [P]
- 24) A patient was dispensed opioid prescriptions by at least 2 different pharmacies such that all the opioid prescriptions were dispensed in a 45-day period and the pharmacies are located in different zip codes. [P]
- 25) An opioid was dispensed to at least 4 different patients on the same day and the opioid prescriptions were for the same base drug, strength and dosage form and were written by the same prescriber. [P, D]

- 26) An opioid was dispensed to at least 3 different patients within an hour and the opioid prescriptions were for the same base drug, strength and dosage form and were written by the same prescriber. [P, D]
- 27) An opioid was dispensed on the same day by the same pharmacy to at least 2 different patients from the same zip code, which was more than 25 miles away from the pharmacy, and the opioid prescriptions were for the same base drug, strength and dosage form and were paid for using cash. [P]
- 28) An opioid was dispensed on the same day by the same pharmacy to at least 2 different patients from the same zip code, which was more than 25 miles away from the pharmacy, and the opioid prescriptions were for the same base drug, strength and dosage form and were written by the same prescriber. [P, D]
- 29) An opioid prescription was refilled more than 5 days before the patient's previous opioid prescription should have run out. For this test, I was asked to flag only the refill and not the original prescription. [P, D]
- 30) Another opioid prescription was filled more than 5 days before a patient's previous opioid prescription should have run out and the two opioid prescriptions were for the same base drug, strength and dosage form. For this test, I was asked to flag only the subsequent prescription. [P]
- 31) The "days of supply" in any 6-month period for any individual drug/strength/dosage form of opioid dispensed to a patient was greater

than 210 days. For this test, I was asked to calculate separately for each drug/strength/dosage form of opioid the patient received. [P]

- 32) A patient was dispensed more than 90 dosage units of the same opioid base drug, strength and dosage form at least twice in a 20-day period and the patient paid cash for at least one of the prescriptions. [P]
- 33) More than 1 immediate-release opioid and more than 1 extended-release opioid were dispensed to the same patient in a 20-day period. [P]
- 34) At least 3 opioid prescriptions of the same base drug, strength and dosage form were written to the same patient by the same prescriber on the same day. [P, D]
- 35) A patient received opioid prescriptions from the same prescriber on at least 4 dates within a 45-day period. [P, D]
- 36) A prescriber wrote opioid prescriptions to at least 2 patients over a 5-day period, and each patient is located more than 25 miles away from the prescriber. [P, D]
- 37) An opioid prescription that was written by a top 5% prescriber of an opioid drug (same base drug, strength and dosage form), this opioid drug accounted for more than 50% of the opioids prescribed by this prescriber, **and** more than 50% of the patients receiving this opioid drug from this prescriber paid cash at least once. [P, D]
- 38) An opioid and a [benzodiazepine or muscle relaxer] were dispensed to a patient on the same day and both prescriptions were written by the same prescriber. [P, D]

- 39) An opioid, a benzodiazepine and a muscle relaxer were dispensed to a patient on the same day and all the prescriptions were written by the same prescriber. [P, D]
- 40) 3 or more opioid prescriptions were dispensed to a patient on the same day. [P]
- 41) An opioid and a [benzodiazepine or muscle relaxer] were dispensed to a patient within a single day on two different days within a 30-day period. [P]
- 42) At least 2 opioid prescriptions and at least 2 [benzodiazepine or muscle relaxer] prescriptions were dispensed to a patient within a 14-day period. [P]
- 43) At least 3 opioid prescriptions were dispensed to a patient within a 30-day period; and the patient paid cash for each of these prescriptions and had no other non-cash payment transactions for controlled substances during the same 30-day period; and this patient was dispensed at least 2 [benzodiazepine or muscle relaxer] prescriptions in the same 30-day period. [P]

B. Summary on 43 Red Flags, Recurrent

213. For the prescriptions summarized below, if a prescription was flagged by one of the 43 red flags, all subsequent prescriptions dispensed to the same patient and/or written by same prescriber are also flagged. Dispensed opioids that are flagged in this manner are summarized below:

1. CVS

Figure 36 CVS Prescriptions Flagged for Any Reason, 43 Red Flags Recurrent, Lake County, OH

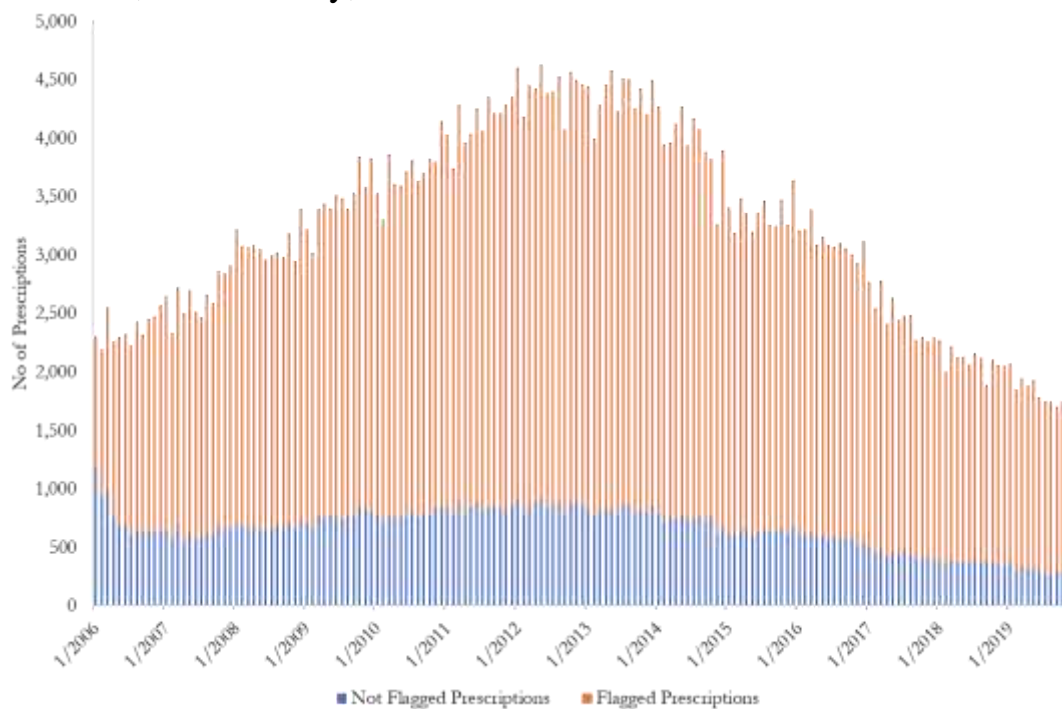
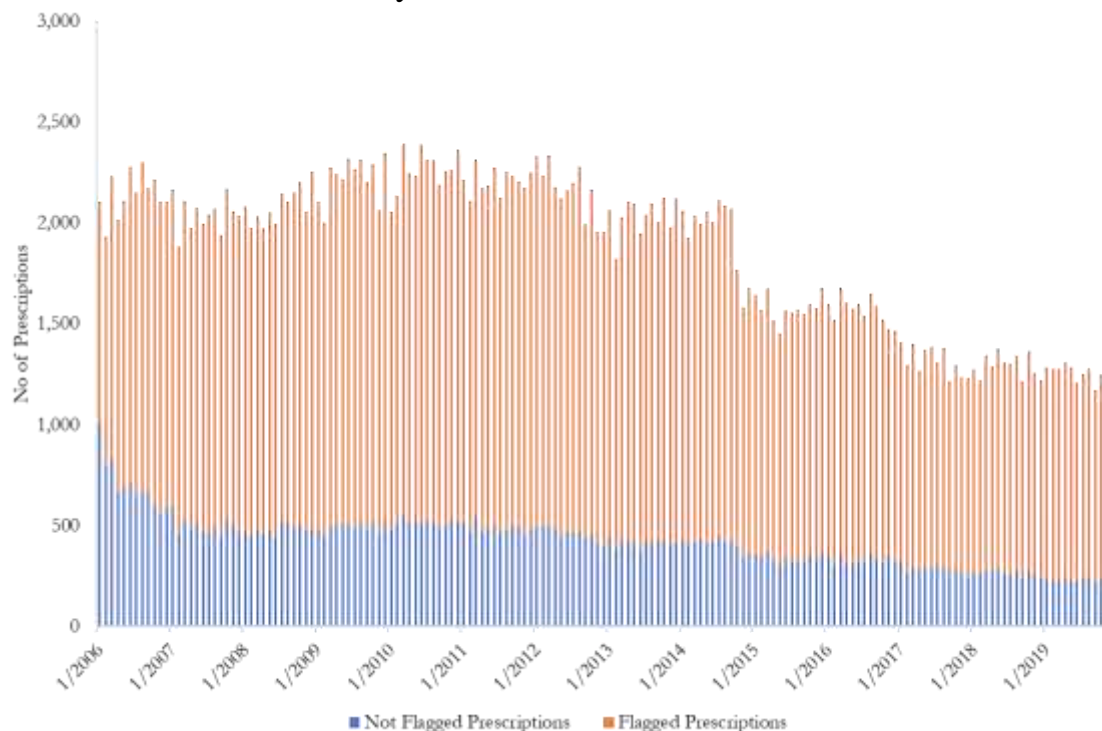


Figure 37 CVS Prescriptions Flagged for Any Reason, 43 Red Flags Recurrent, Trumbull County, OH



2. *HBC Service Company*

Figure 38 HBC Prescriptions Flagged for Any Reason, 43 Red Flags Recurrent, Lake County, OH

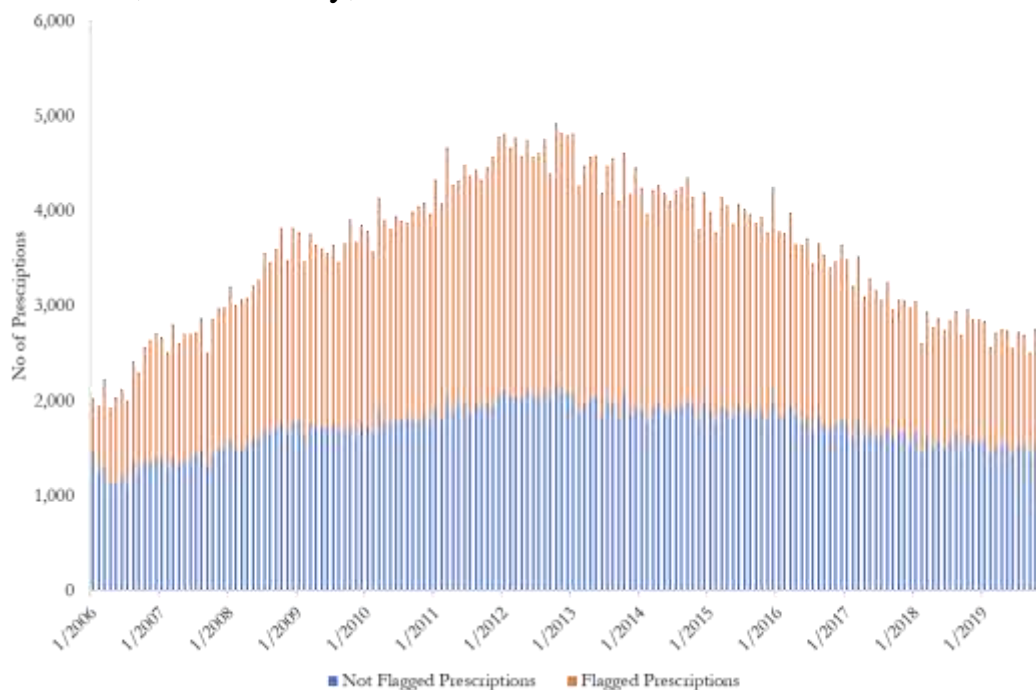
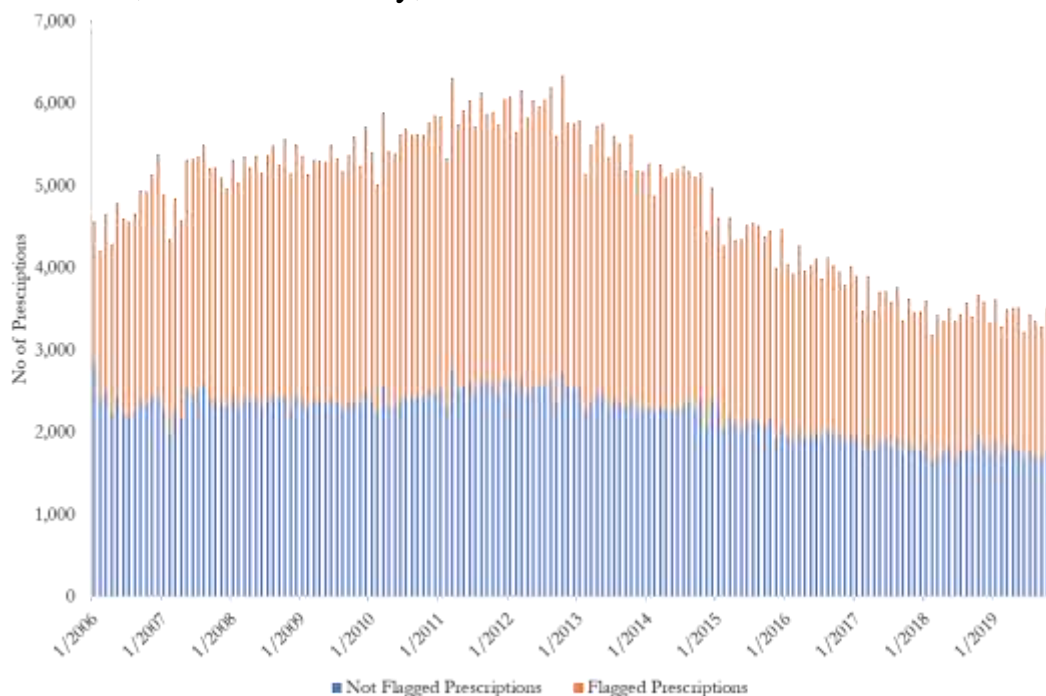
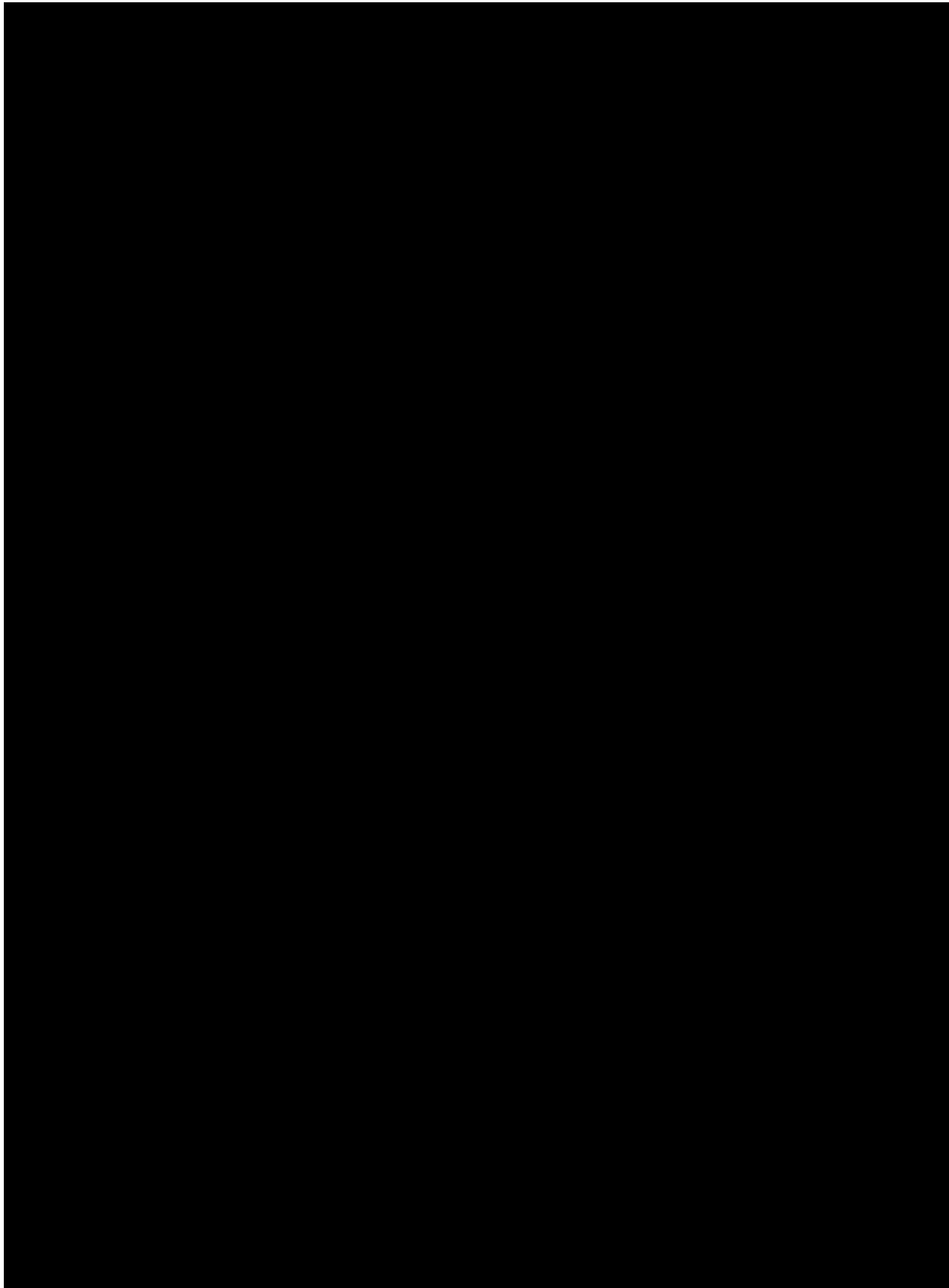


Figure 39 HBC Prescriptions Flagged for Any Reason, 43 Red Flags Recurrent, Trumbull County, OH





4. Walgreens

Figure 42 Walgreens Prescriptions Flagged for Any Reason, 43 Red Flags Recurrent, Lake County, OH

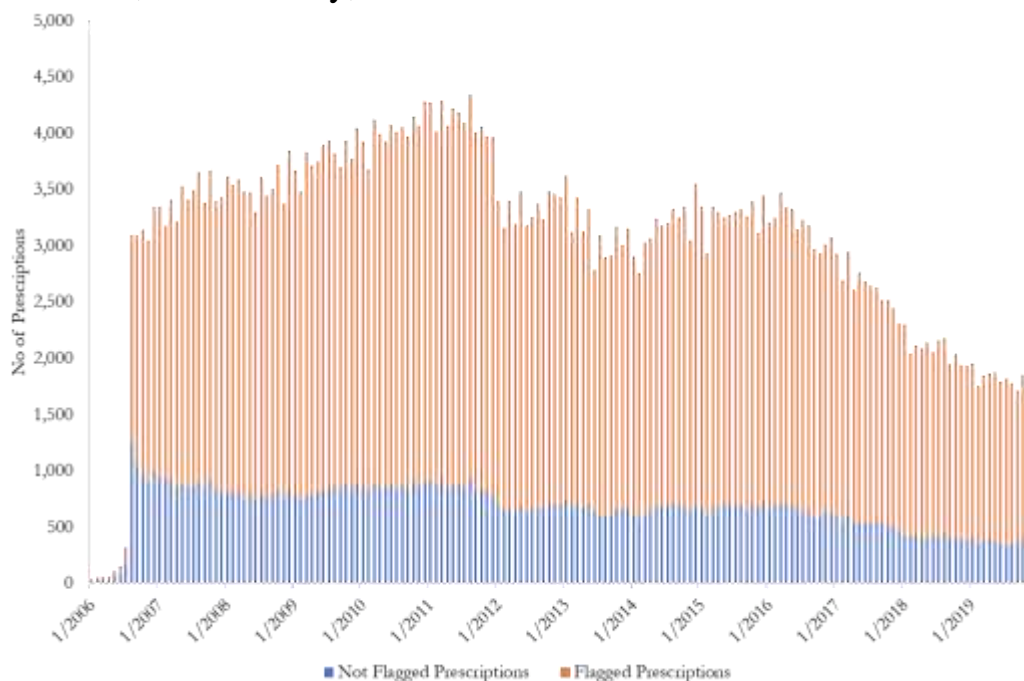
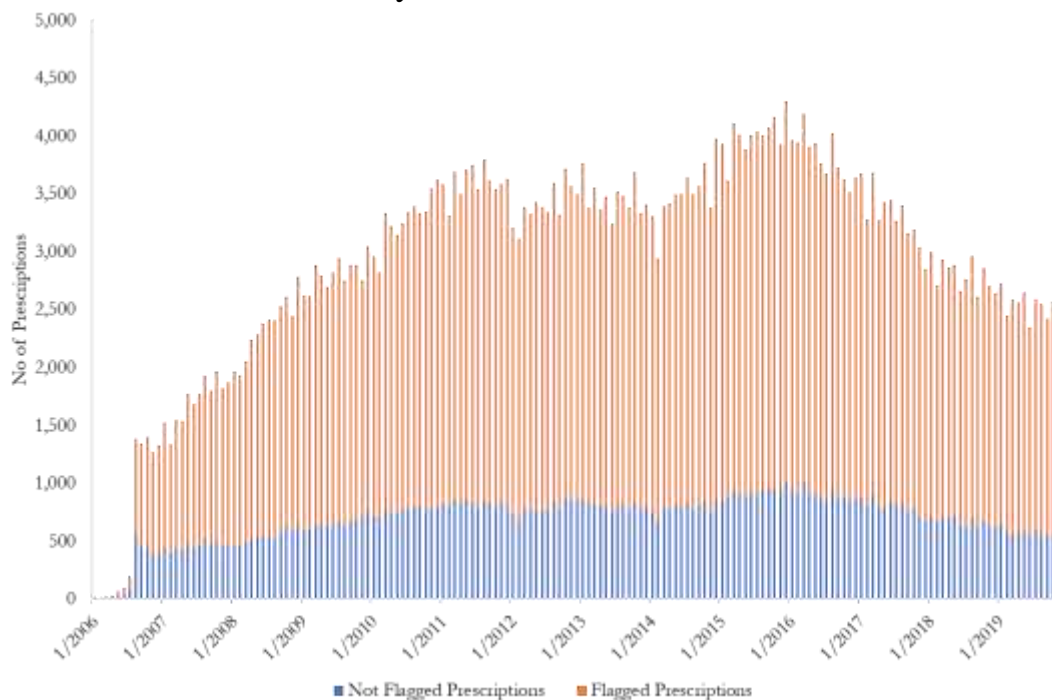


Figure 43 Walgreens Prescriptions Flagged for Any Reason, 43 Red Flags Recurrent, Trumbull County, OH



5. Wal-Mart

Figure 44 Wal-Mart Prescriptions Flagged for Any Reason, 43 Red Flags Recurrent, Lake County, OH

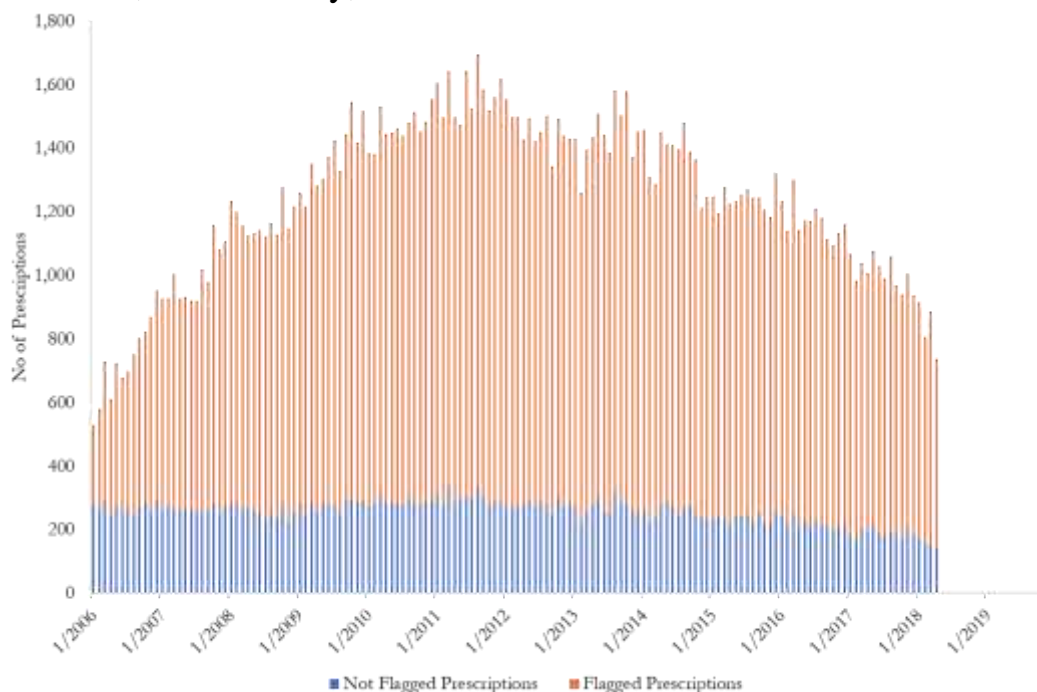
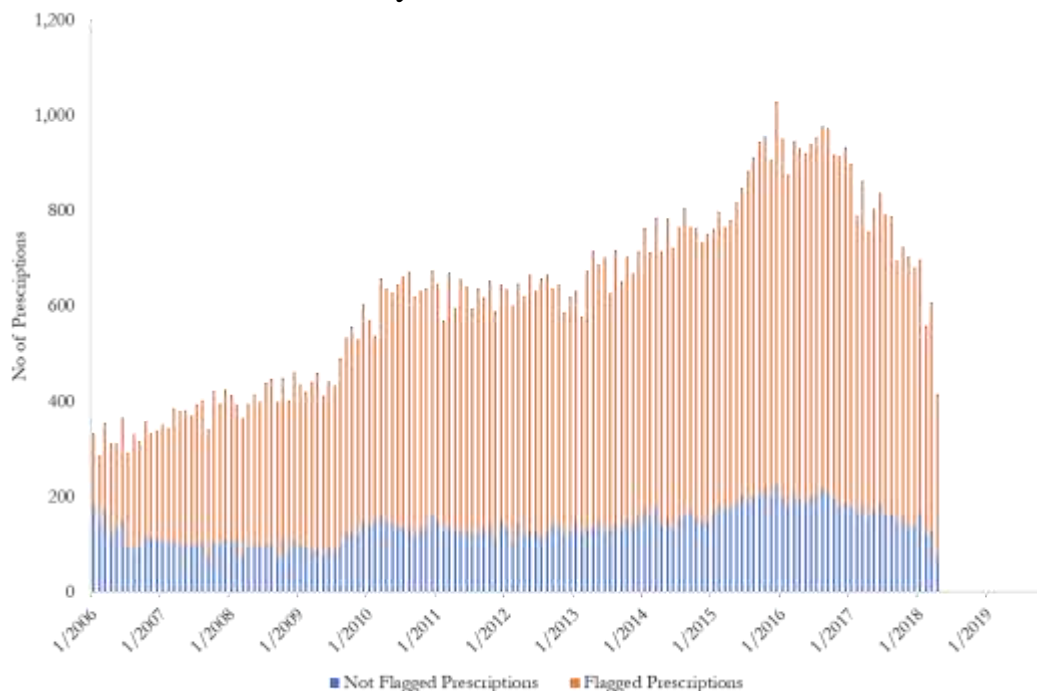


Figure 45 Wal-Mart Prescriptions Flagged for Any Reason, 43 Red Flags Recurrent, Trumbull County, OH



C. Summary on 43 Red Flags, Non-recurrent

214. For the prescriptions summarized below, if a prescription was flagged by one of the 43 red flags only that prescription was flagged (and all subsequent prescriptions dispensed to the same patient and/or written by same prescriber were not flagged). Dispensed opioids that are flagged in this manner are summarized below:

1. CVS

Figure 46 CVS Prescriptions Flagged for Any Reason, 43 Red Flags Non-recurrent, Lake County, OH

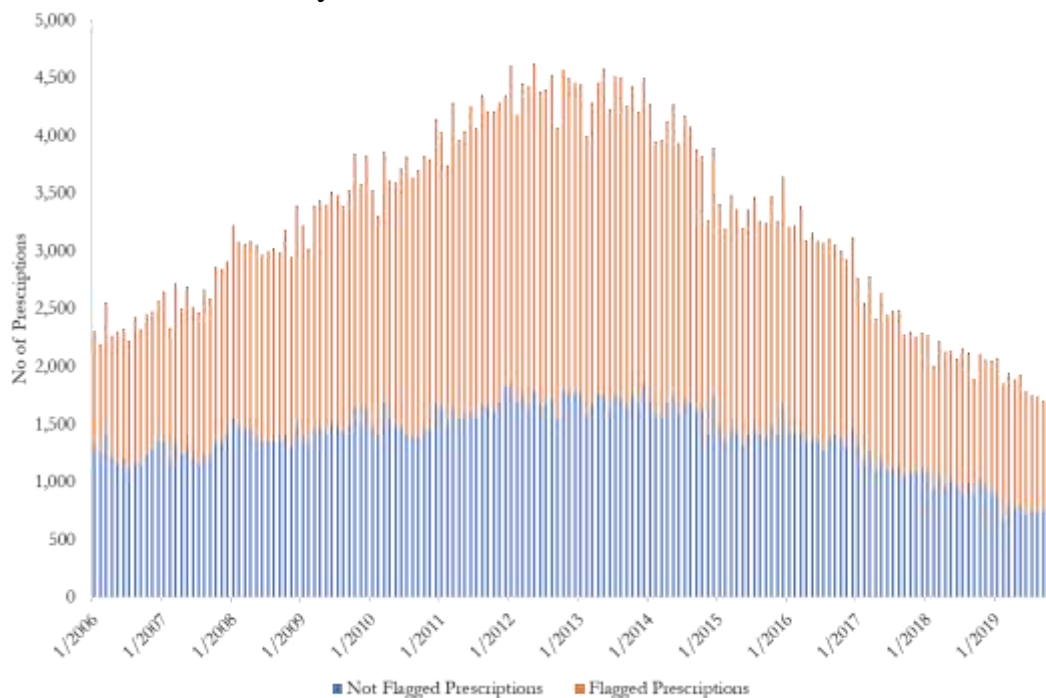
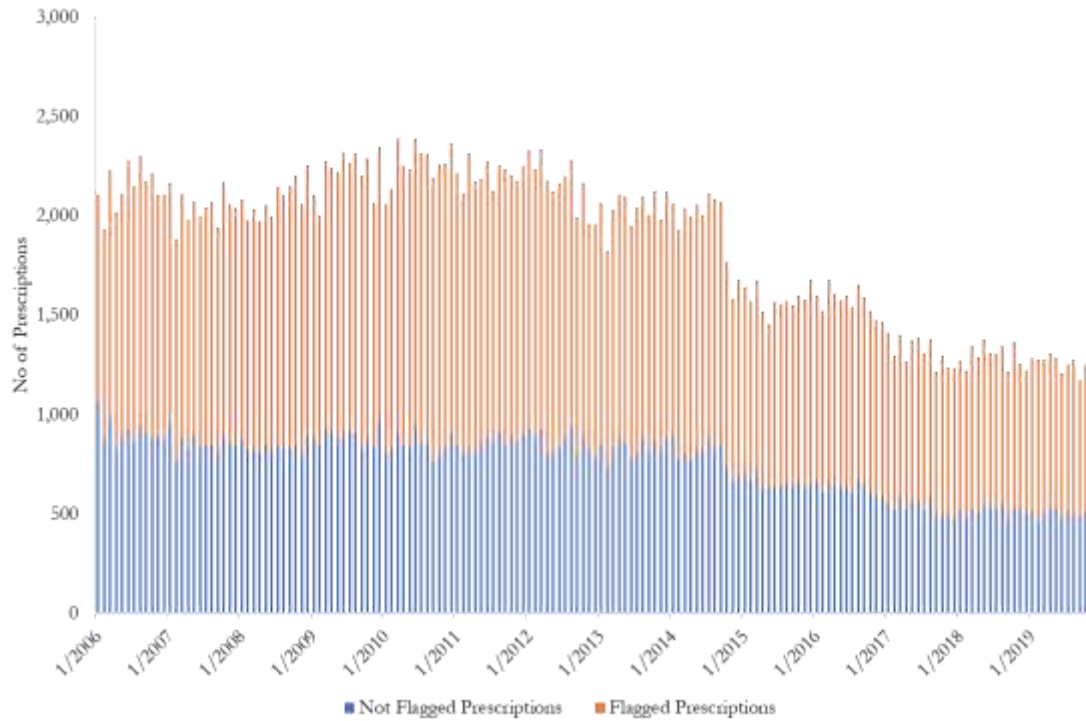


Figure 47 CVS Prescriptions Flagged for Any Reason, 43 Red Flags Non-recurrent, Trumbull County, OH



2. *HBC Service Company*

Figure 48 HBC Prescriptions Flagged for Any Reason, 43 Red Flags Non-recurrent, Lake County, OH

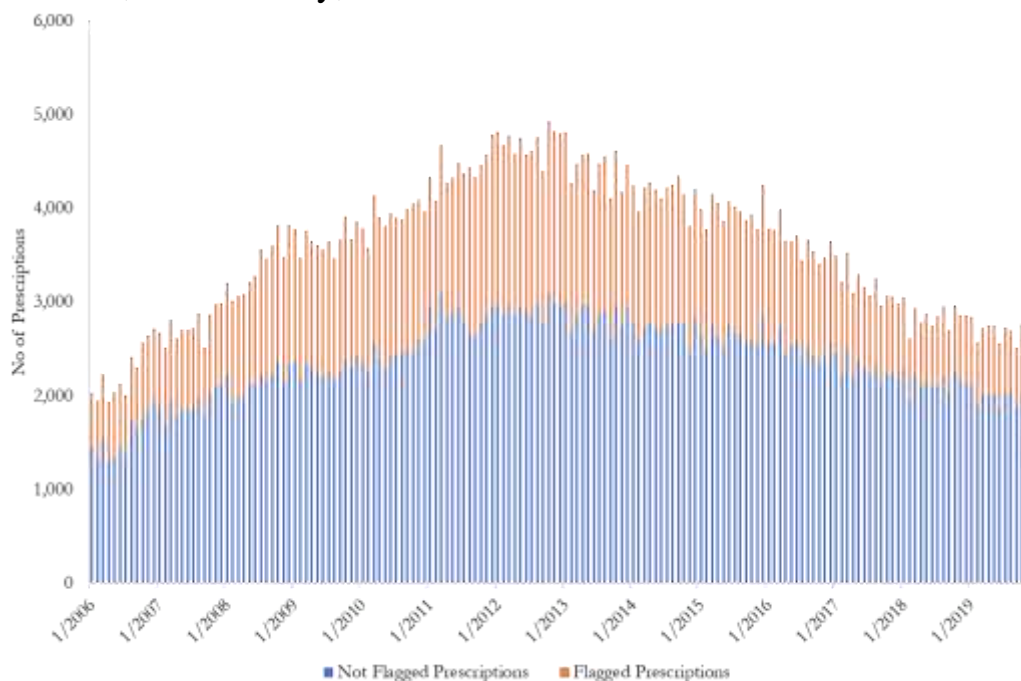
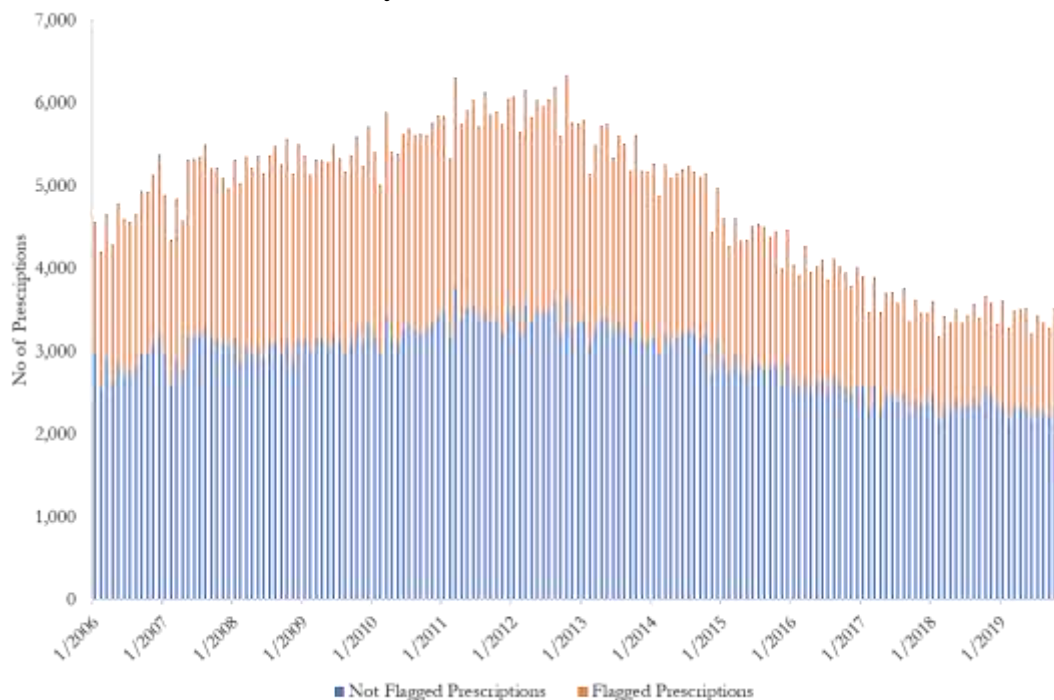
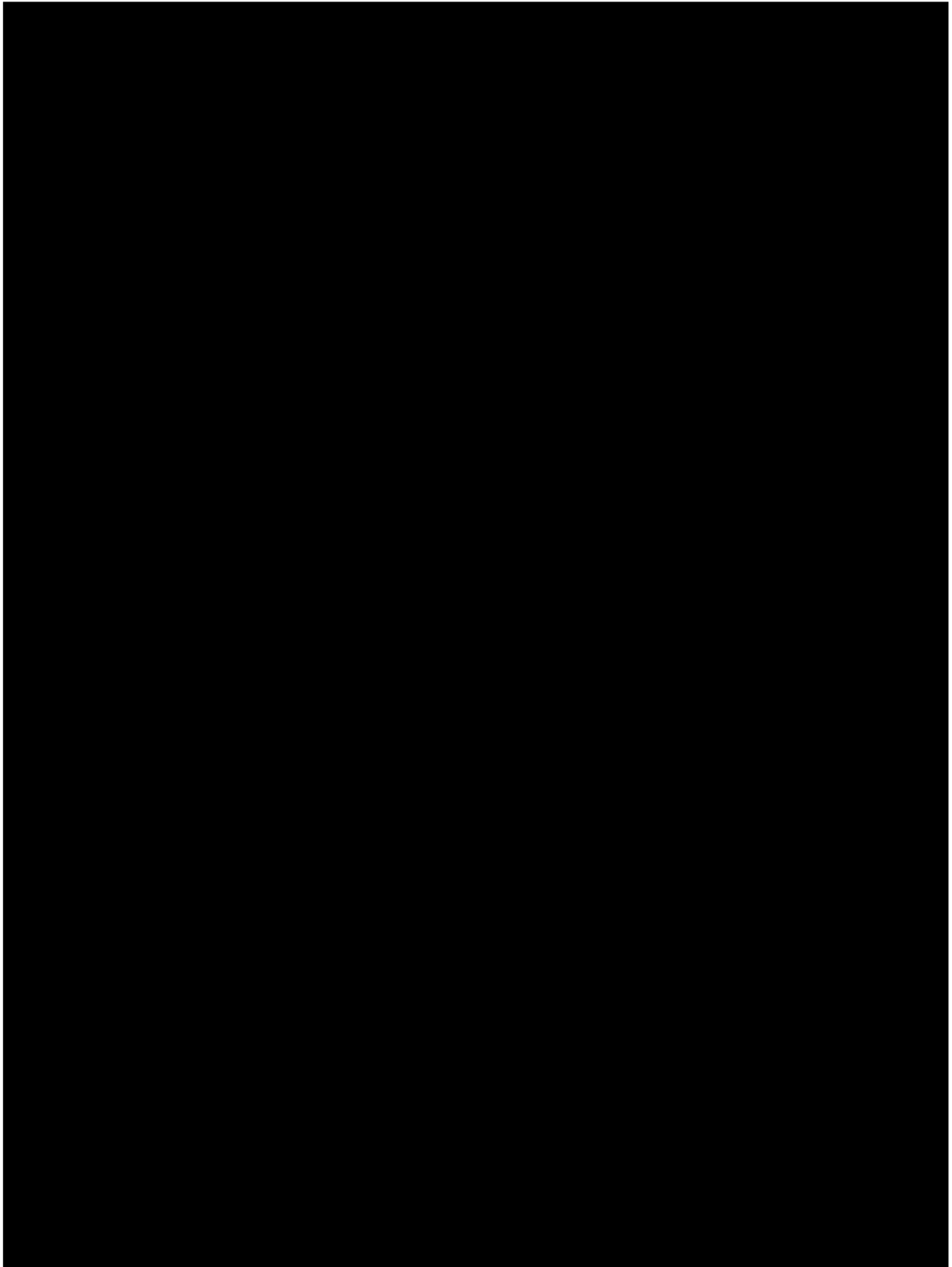


Figure 49 HBC Prescriptions Flagged for Any Reason, 43 Red Flags Non-recurrent, Trumbull County, OH





4. Walgreens

Figure 52 Walgreens Prescriptions Flagged for Any Reason, 43 Red Flags Non-recurrent, Lake County, OH

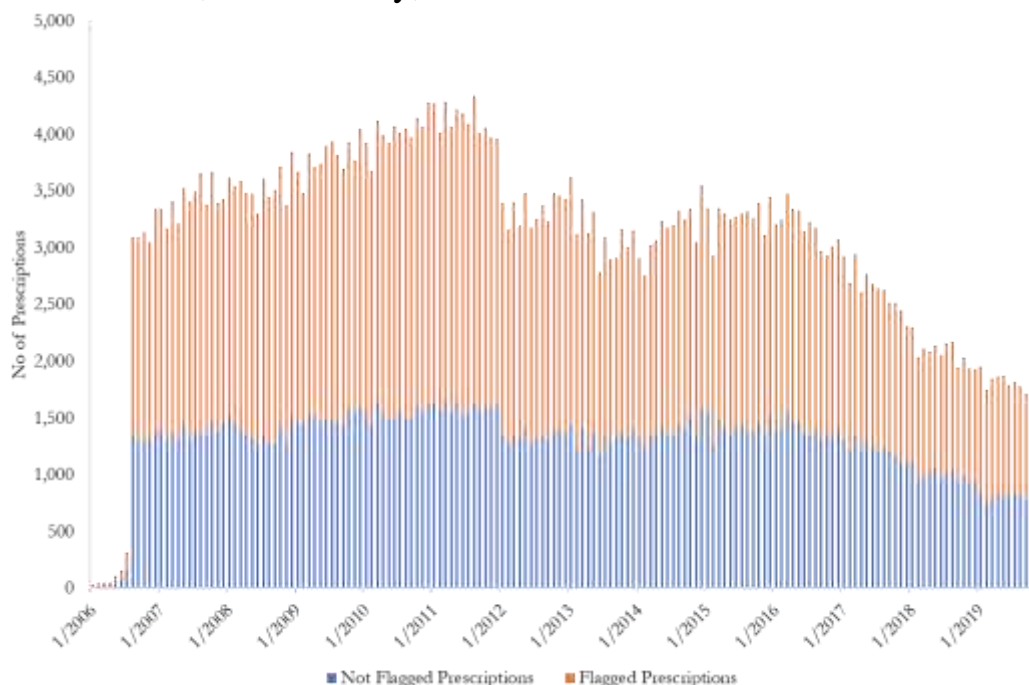
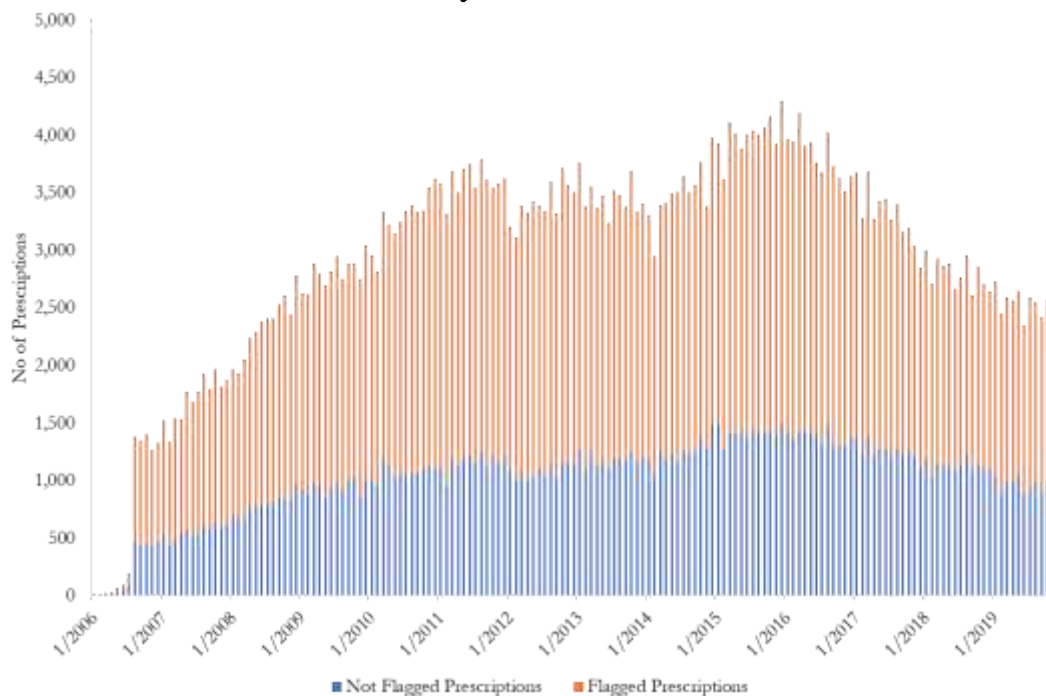


Figure 53 Walgreens Prescriptions Flagged for Any Reason, 43 Red Flags Non-recurrent, Trumbull County, OH



5. Wal-Mart

Figure 54 Wal-Mart Prescriptions Flagged for Any Reason, 43 Red Flags Non-recurrent, Lake County, OH

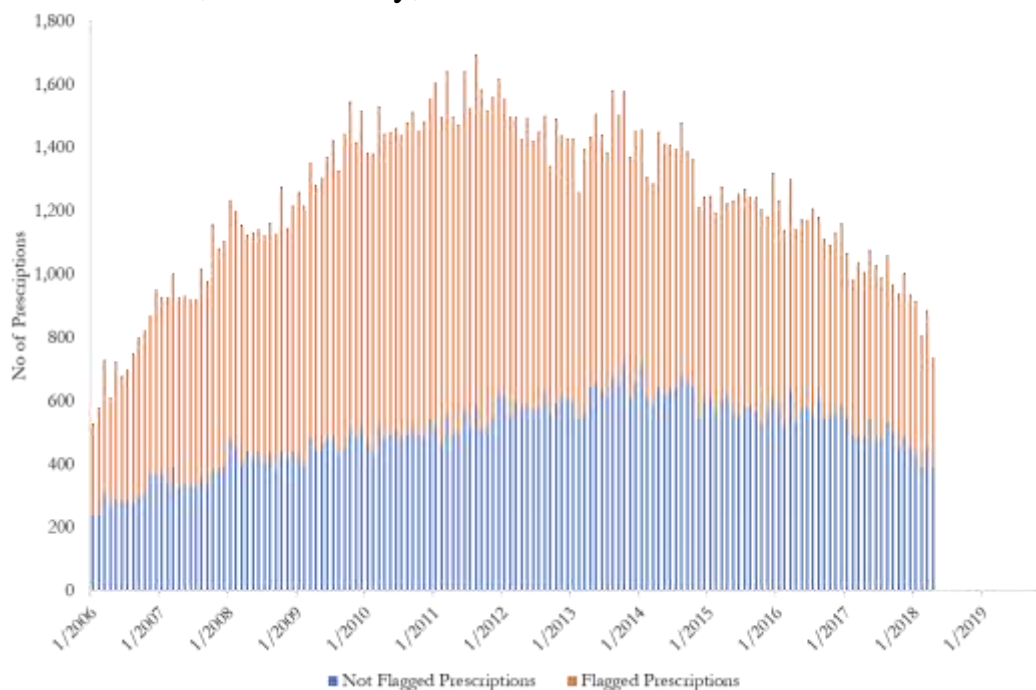
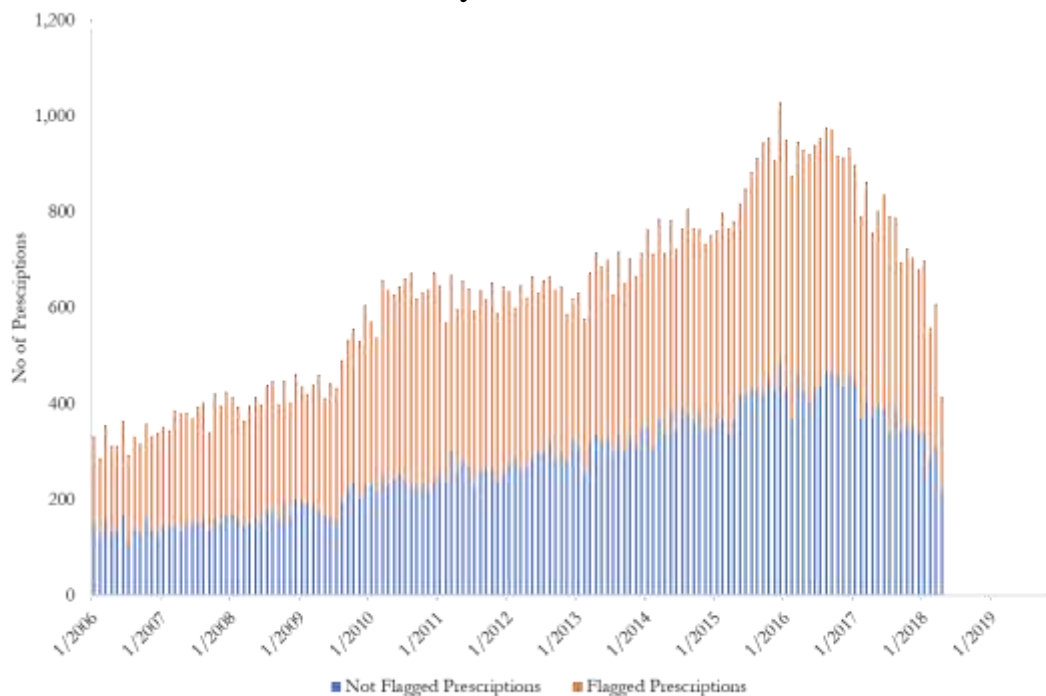


Figure 55 Wal-Mart Prescriptions Flagged for Any Reason, 43 Red Flags Non-recurrent, Trumbull County, OH



D. Summary on 11 Red Flags, Recurrent

215. For the prescriptions summarized below, if a prescription was flagged by one of the selected 11 red flags (Flag 1, 2, 3, 4, 7, 9, 11, 12, 14, 15, and 16), all subsequent prescriptions dispensed to the same patient and/or written by same prescriber are also flagged. Dispensed opioids that are flagged in this manner are summarized below:

1. CVS

Figure 56 CVS Prescriptions Flagged for Any Reason, 11 Red Flags Recurrent, Lake County, OH

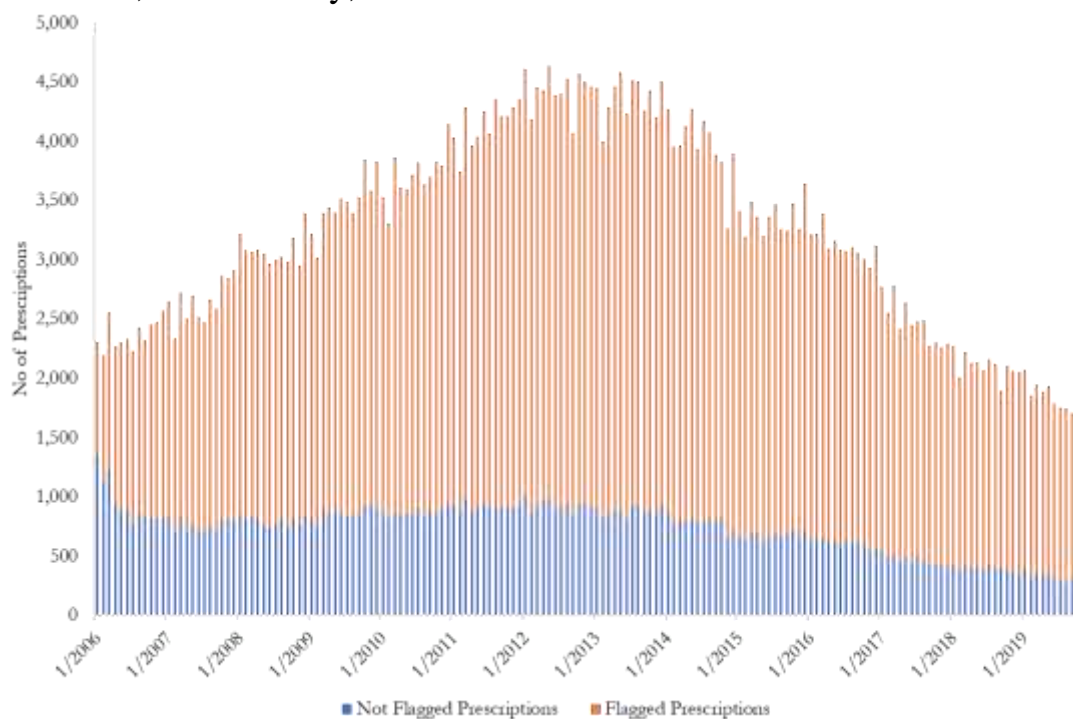
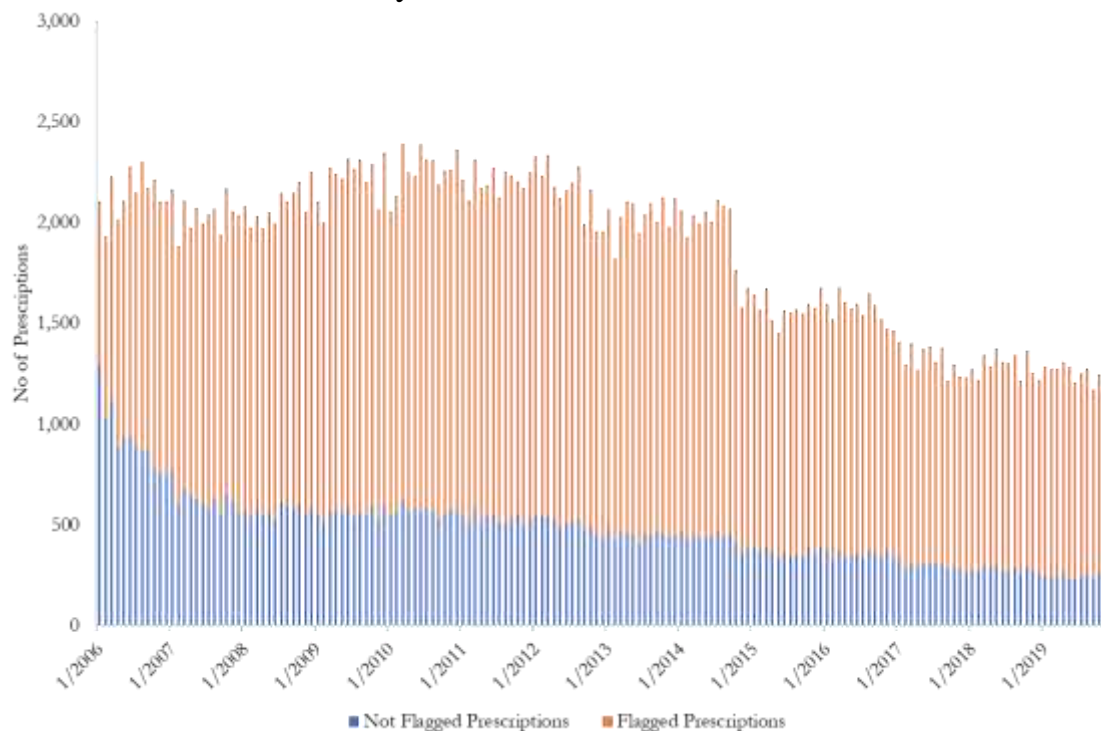


Figure 57 CVS Prescriptions Flagged for Any Reason, 11 Red Flags Recurrent, Trumbull County, OH



2. HBC Service Company

Figure 58 HBC Prescriptions Flagged for Any Reason, 11 Red Flags Recurrent, Lake County, OH

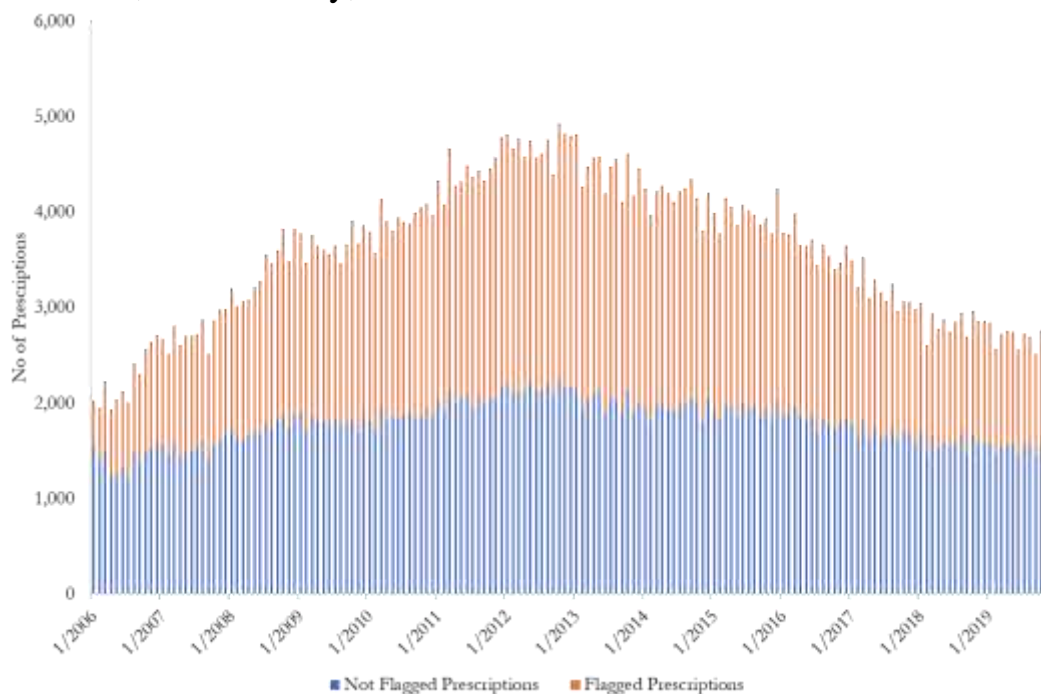
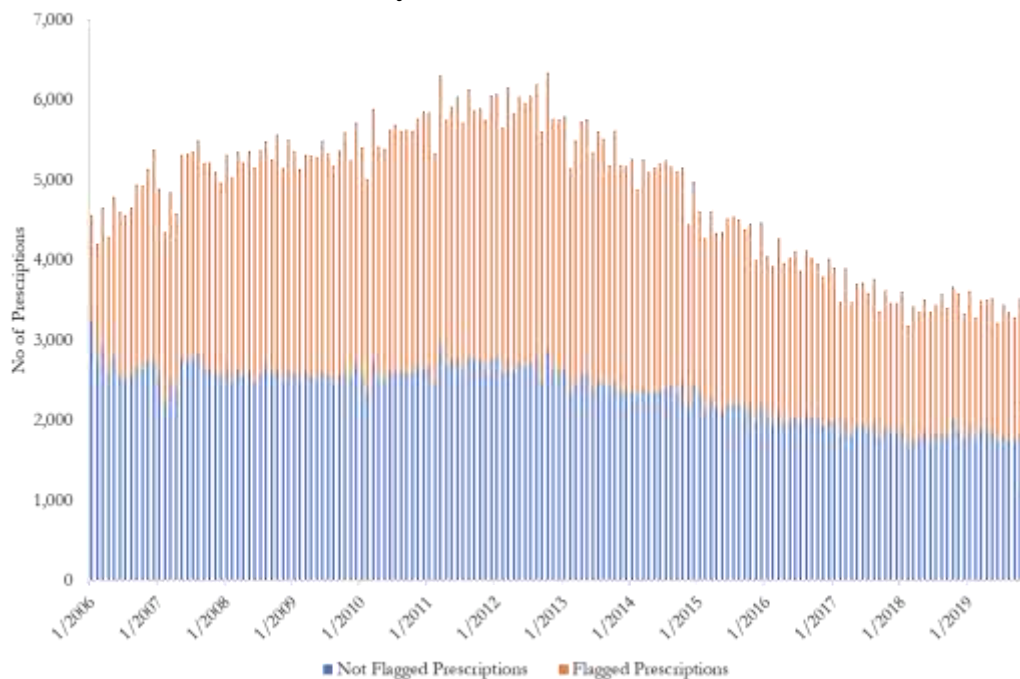
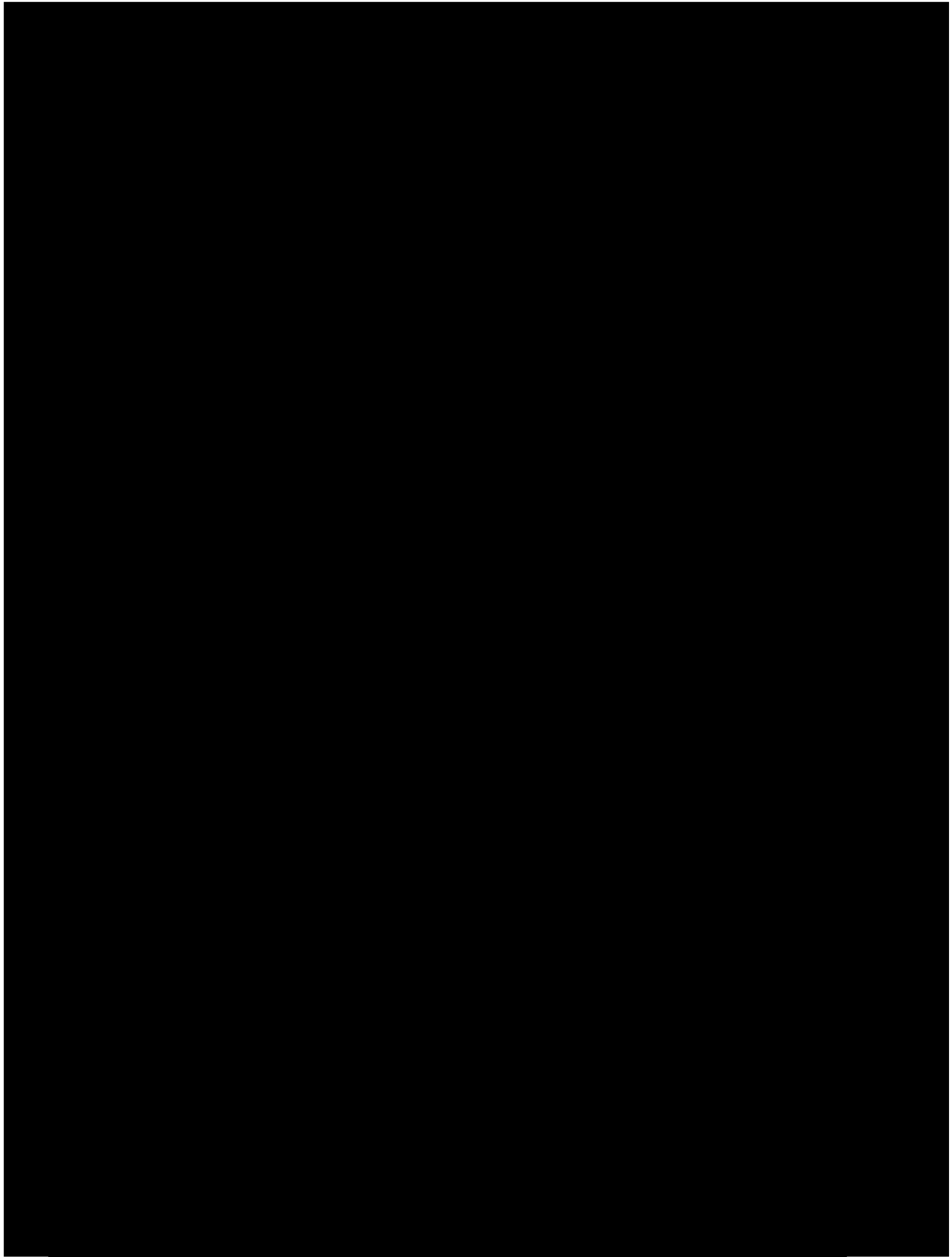


Figure 59 HBC Prescriptions Flagged for Any Reason, 11 Red Flags Recurrent, Trumbull County, OH





4. Walgreens

Figure 62 Walgreens Prescriptions Flagged for Any Reason, 11 Red Flags Recurrent, Lake County, OH

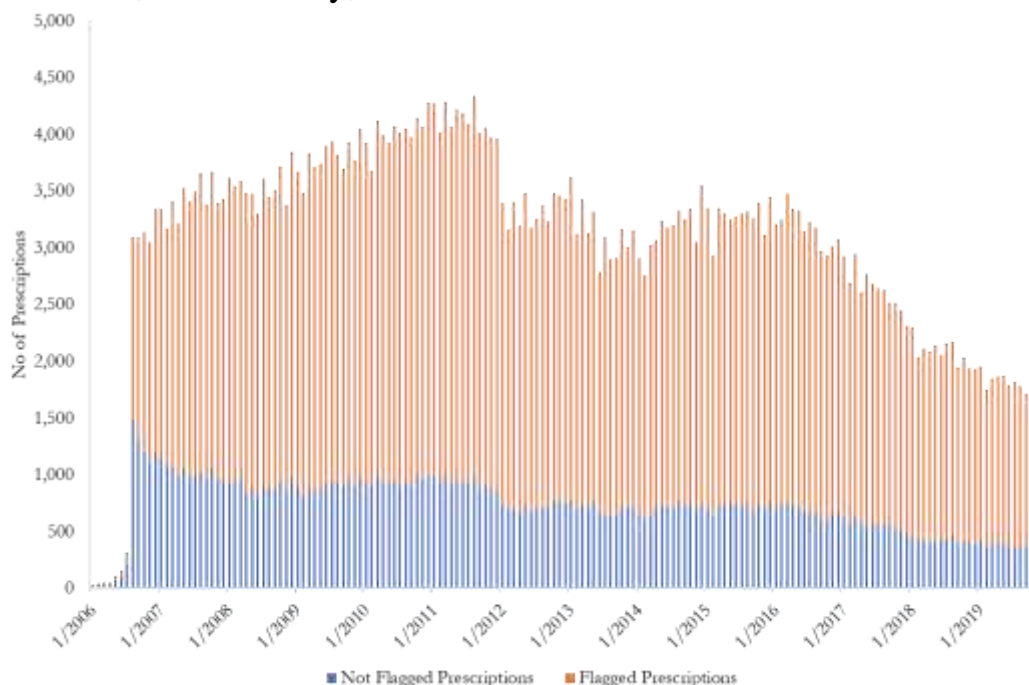
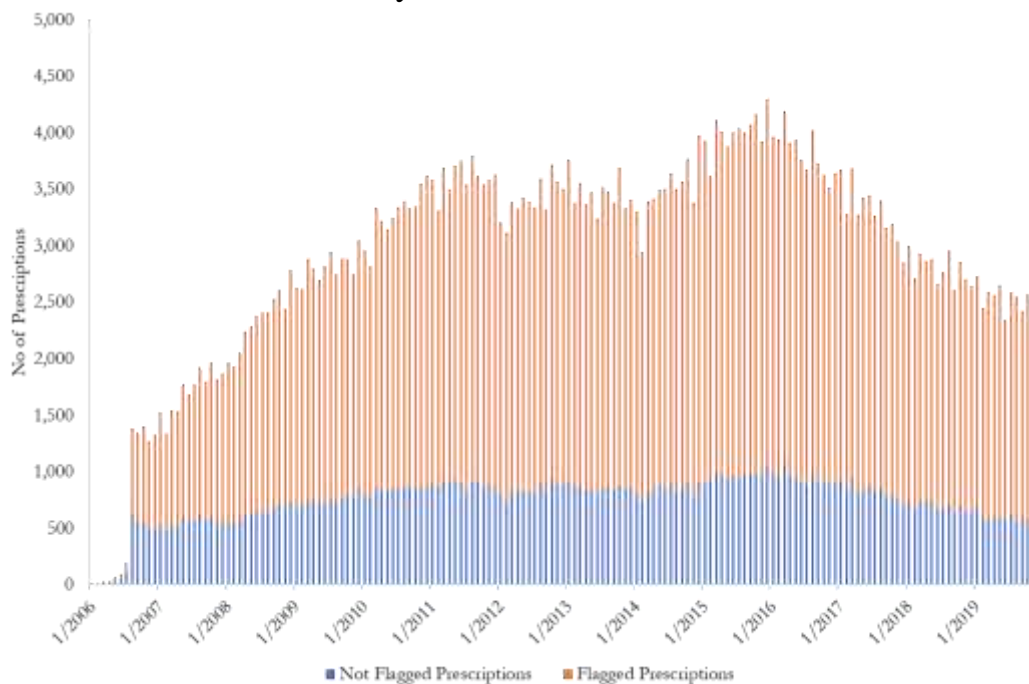


Figure 63 Walgreens Prescriptions Flagged for Any Reason, 11 Red Flags Recurrent, Trumbull County, OH



5. Wal-Mart

Figure 64 Wal-Mart Prescriptions Flagged for Any Reason, 11 Red Flags Recurrent, Lake County, OH

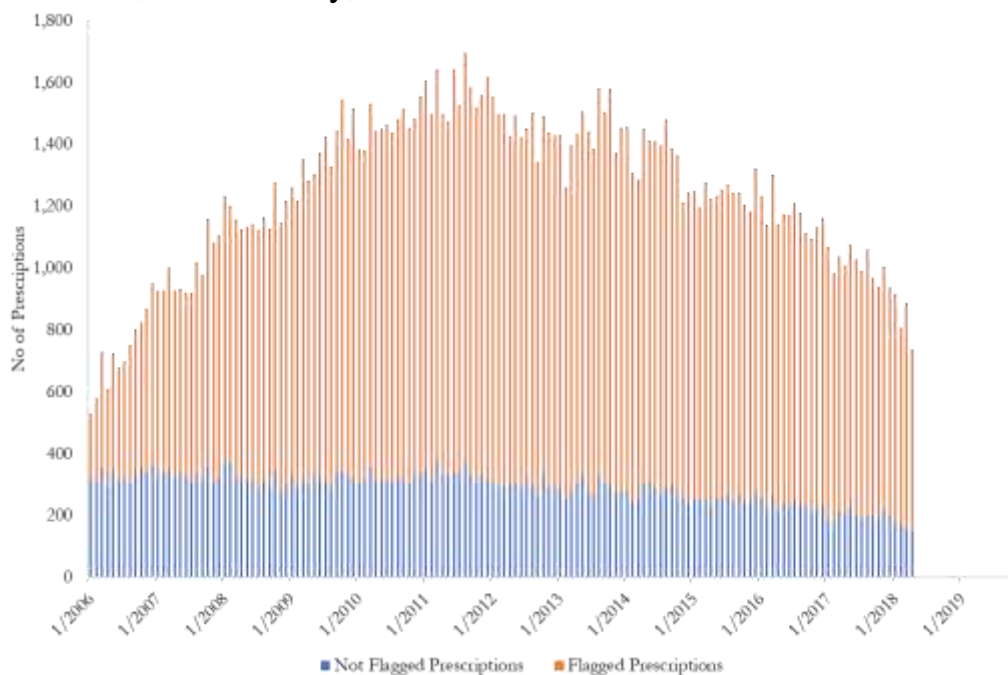
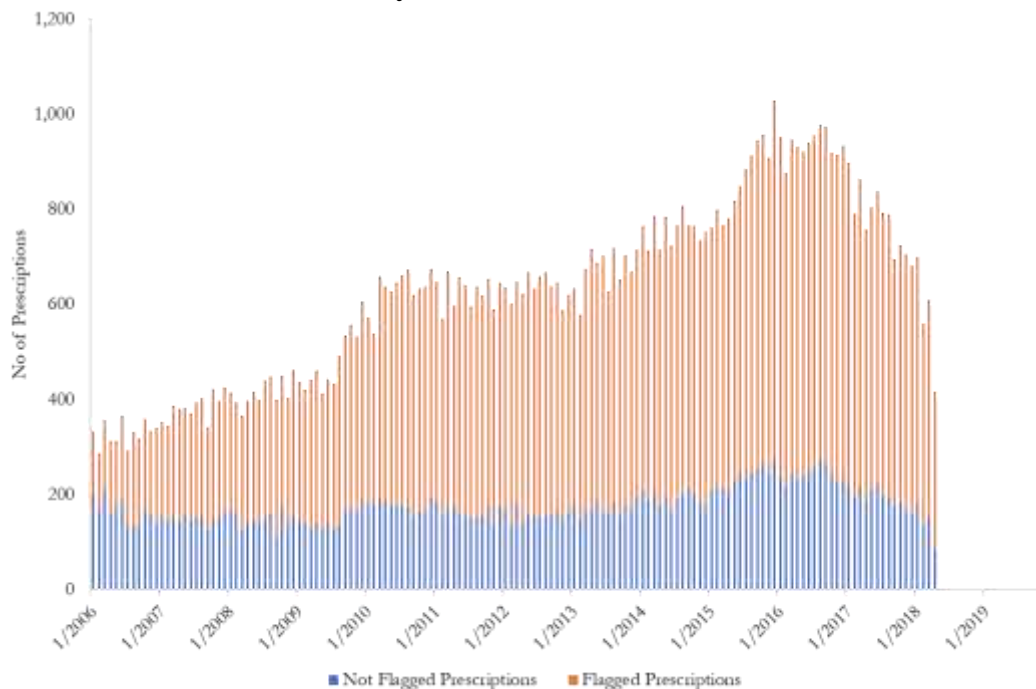


Figure 65 Wal-Mart Prescriptions Flagged for Any Reason, 11 Red Flags Recurrent, Trumbull County, OH



E. Summary on 11 Red Flags, Non-recurrent

216. For the prescriptions summarized below, if a prescription was flagged by one of the selected 11 red flags (Flag 1, 2, 3, 4, 7, 9, 11, 12, 14, 15, and 16), only that prescription was flagged (and all subsequent prescriptions dispensed to the same patient and/or written by same prescriber were not flagged). Dispensed opioids that are flagged in this manner are summarized below:

1. CVS

Figure 66 CVS Prescriptions Flagged for Any Reason, 11 Red Flags Non-recurrent, Lake County, OH

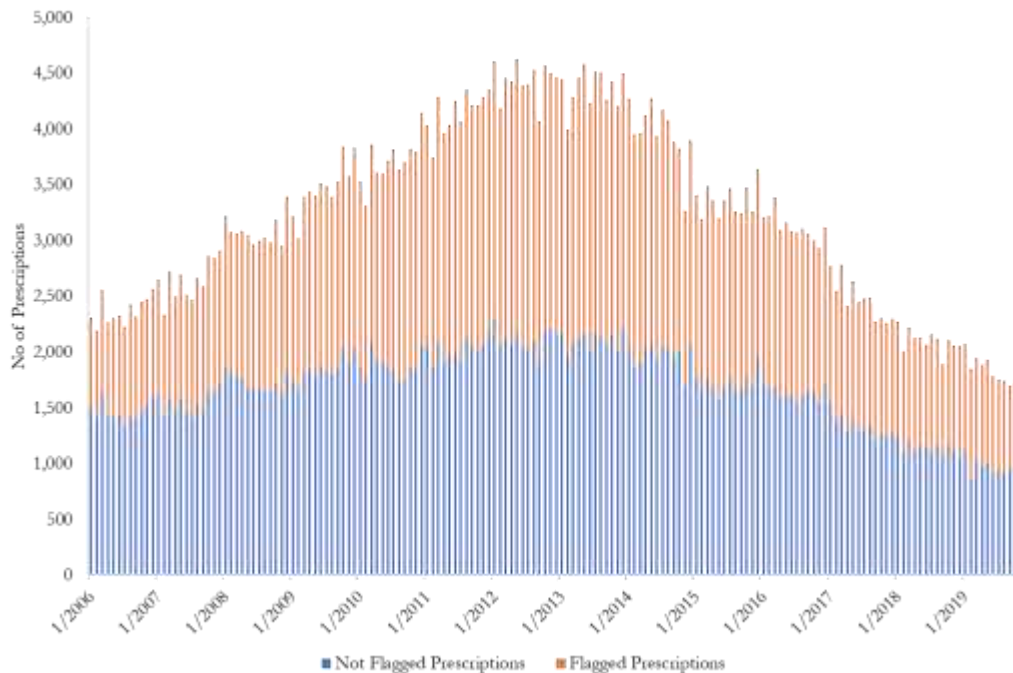
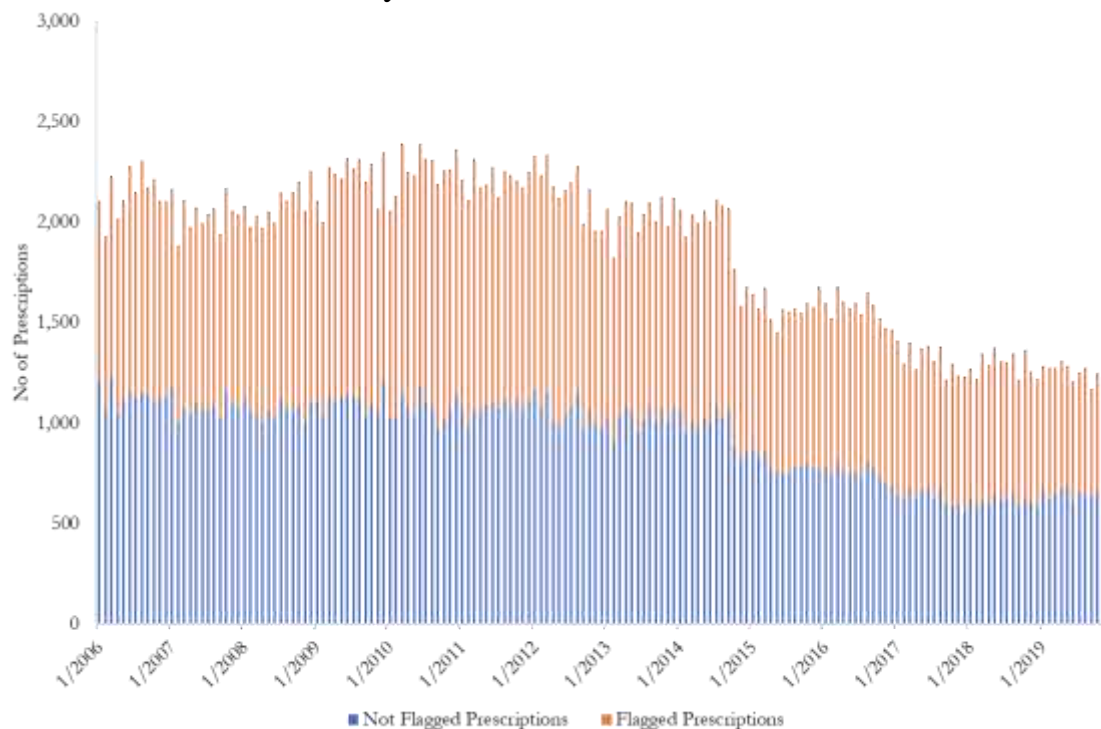


Figure 67 CVS Prescriptions Flagged for Any Reason, 11 Red Flags Non-recurrent, Trumbull County, OH



2. *HBC Service Company*

Figure 68 HBC Prescriptions Flagged for Any Reason, 11 Red Flags Non-recurrent, Lake County, OH

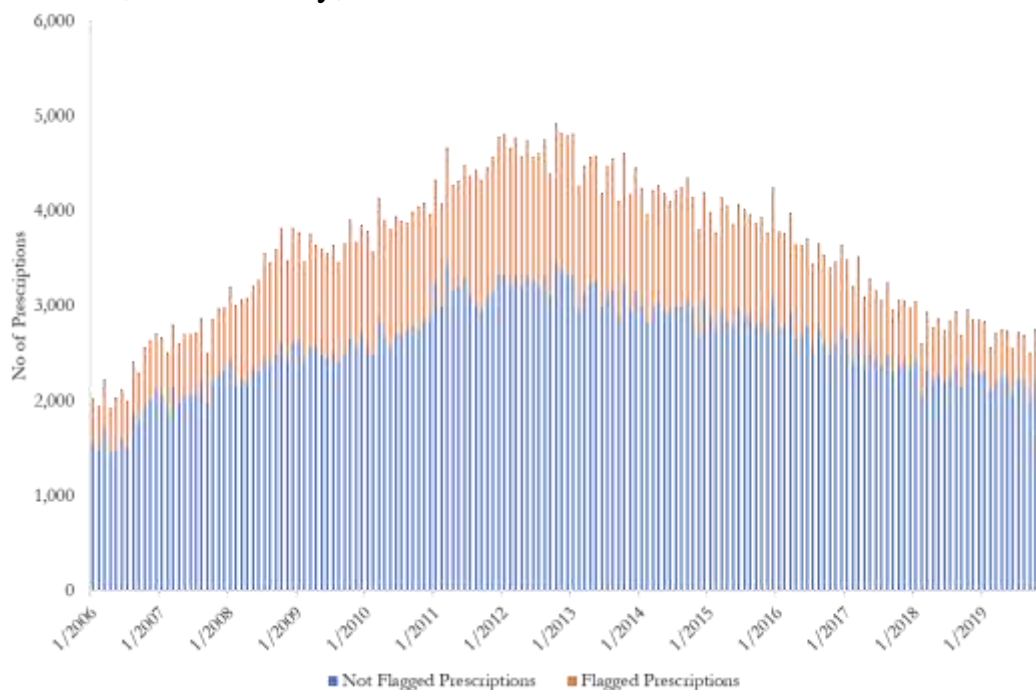
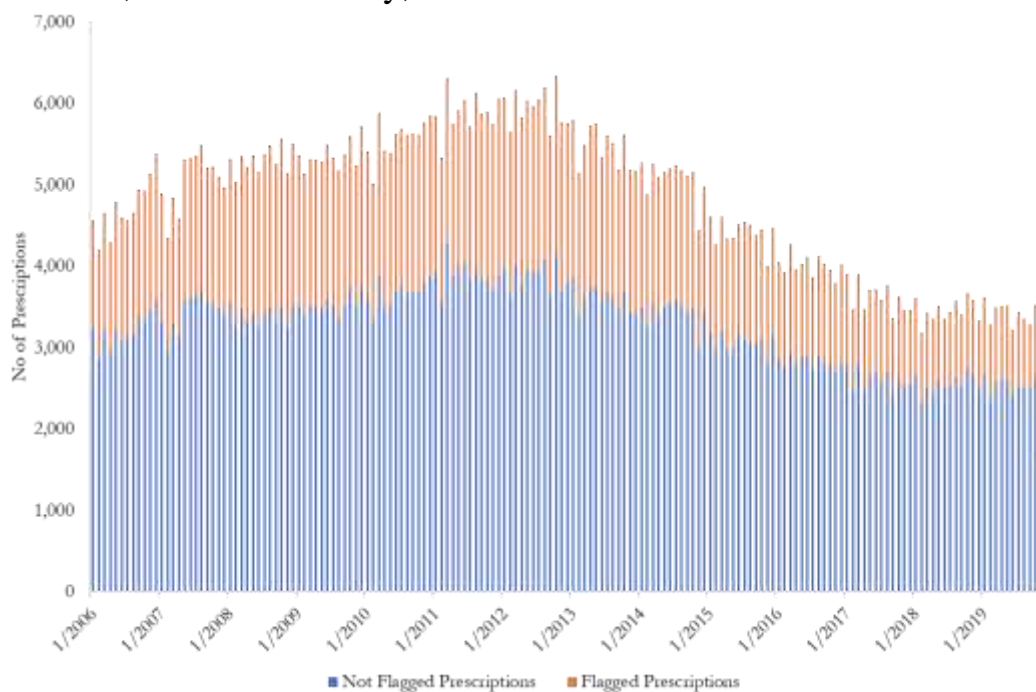
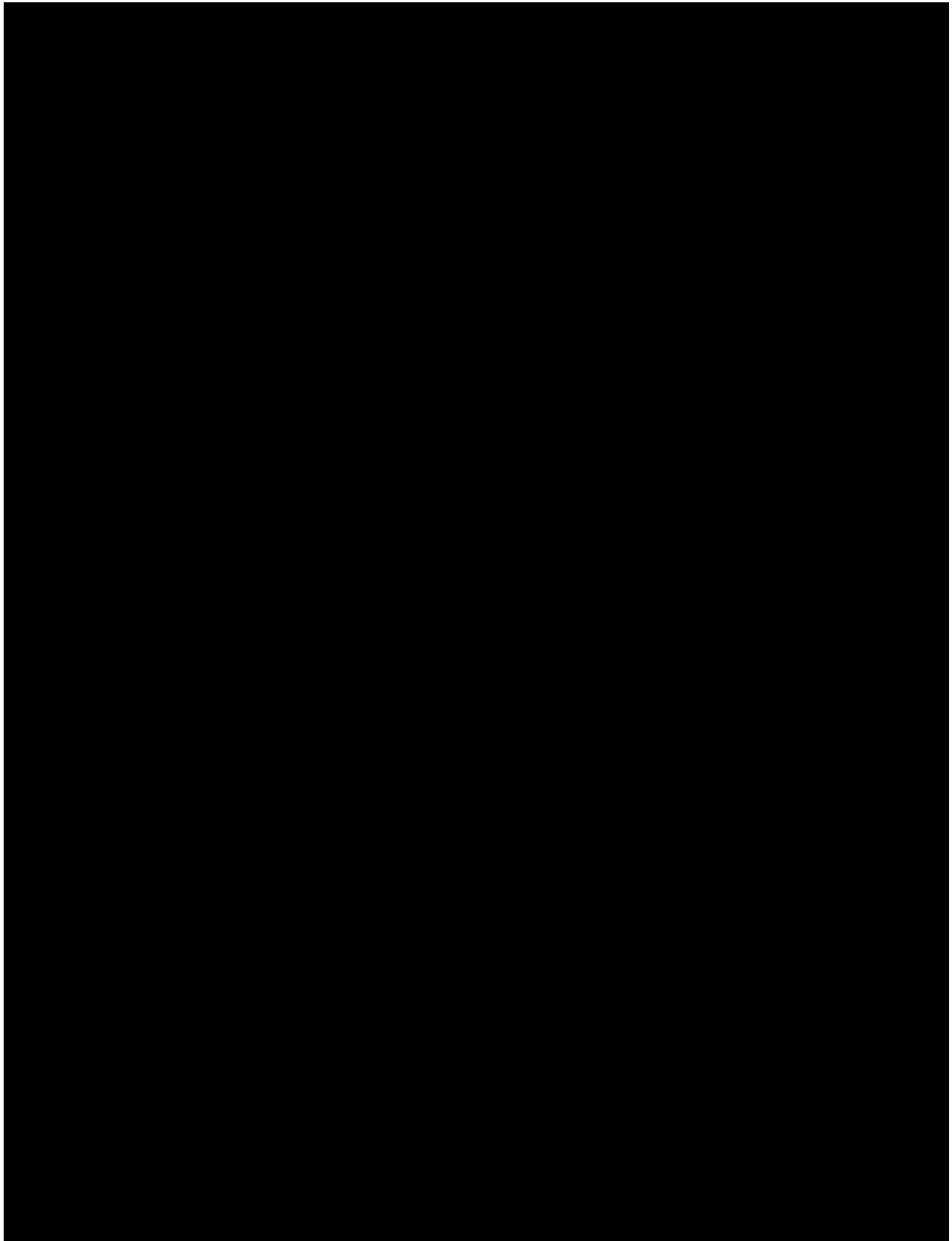


Figure 69 HBC Prescriptions Flagged for Any Reason, 11 Red Flags Non-recurrent, Trumbull County, OH





4. Walgreens

Figure 72 Walgreens Prescriptions Flagged for Any Reason, 11 Red Flags Non-recurrent, Lake County, OH

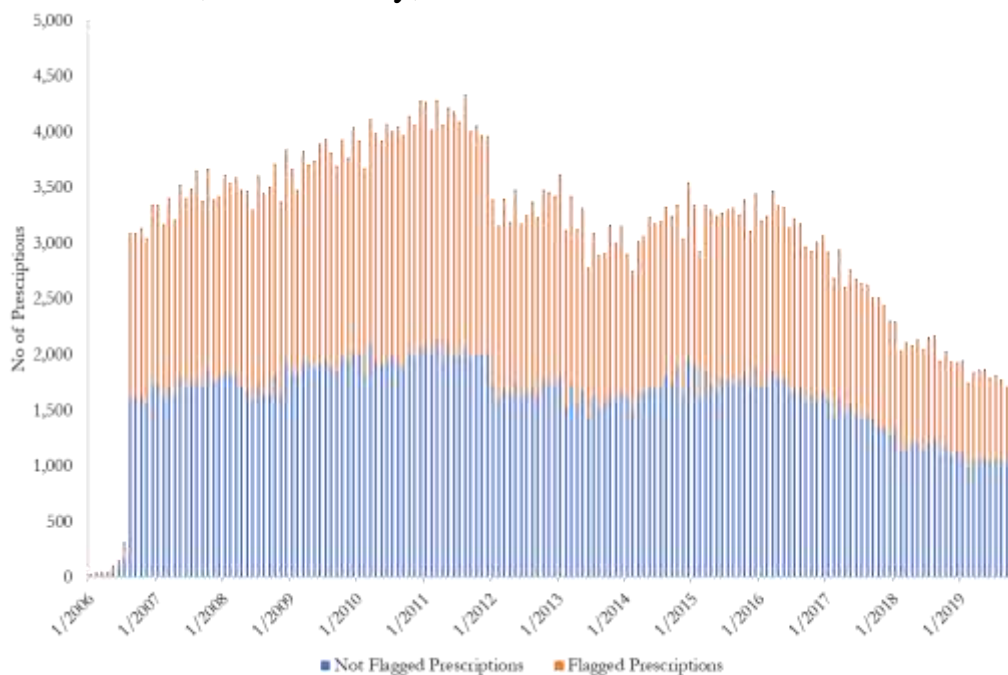
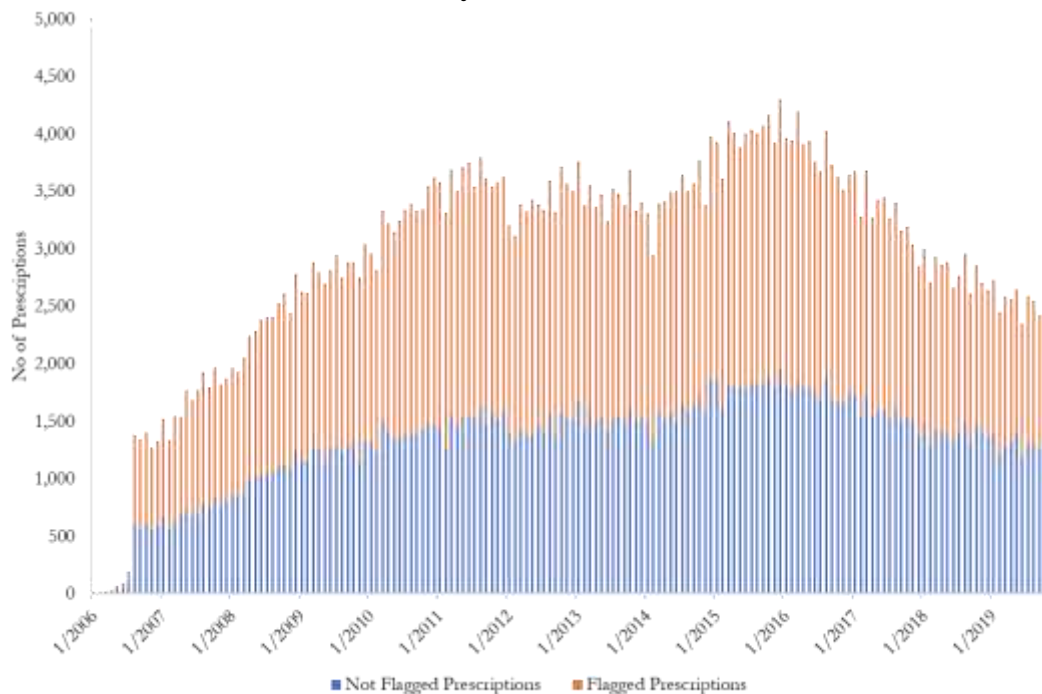


Figure 73 Walgreens Prescriptions Flagged for Any Reason, 11 Red Flags Non-recurrent, Trumbull County, OH



5. Wal-Mart

Figure 74 Wal-Mart Prescriptions Flagged for Any Reason, 11 Red Flags Non-recurrent, Lake County, OH

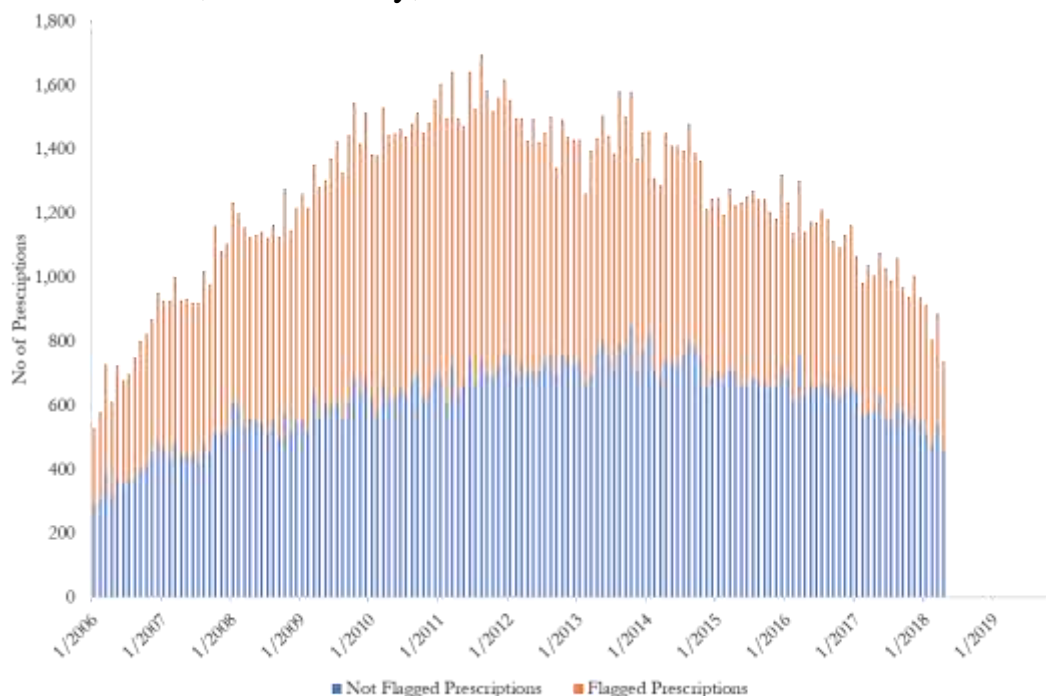
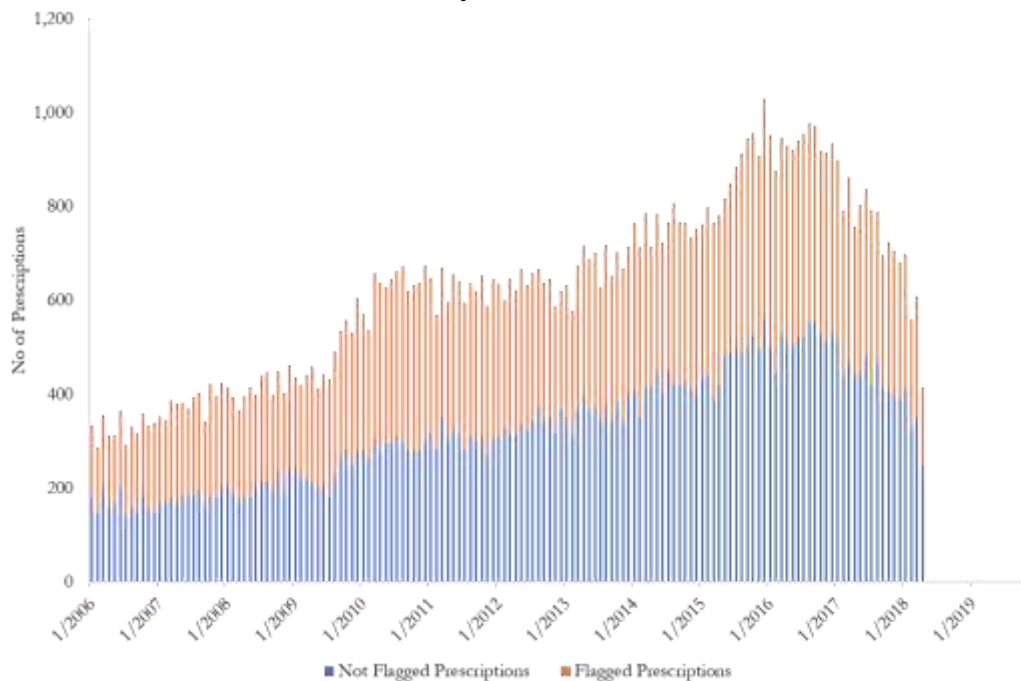


Figure 75 Wal-Mart Prescriptions Flagged for Any Reason, 11 Red Flags Non-recurrent, Trumbull County, OH



XI. Charts and Reports

217. I have created additional Excel Macro and diagnostic tools, which allow the overlay of selected orders upon the ARCOS Data and/or Defendant Transactional Data and provide the ability to sort, compare, and view the order history of an individual pharmacy. These macros and diagnostic tools are being provided with this report.

218. In addition, I have created a set of Charts and Tables that are too voluminous to be displayed and discussed fully here-in. Those additional Charts and Tables are attached in Appendix 10, Appendix 11, and Appendix 12 described generally in this section.

- **Appendix 10A: State Oxycodone and Hydrocodone MME Per Capita, 1997-2019**

219. Using ARCOS Data produced by the DEA for 2006-2014 and public ARCOS Retail Drug Summary Reports otherwise, I plot total oxycodone and hydrocodone MME per capita, by State from 1997 to 2019. There is one chart and a 2-page backup summary table for each oxycodone and hydrocodone.

220. In the two charts, the line reflecting Ohio MME per capita is highlighted using red. The rest of the states are drawn in light grey.

221. The 2-page backup summary tables report oxycodone and hydrocodone MME per capita each year and averaged over the 1997-2019 period. The states are sorted by average MME per capita over the entire 23-year period.

- **Appendix 10B: All Defendants, Combined and Individually, 12 Opioid Drug Distribution by Distributor Defendant**

222. Using ARCOS Data produced by the DEA for 2006-2014 and Distributor Defendants' Transactional Data for the periods before 2006 and after 2014, I plot all Distributor Defendants' shipments of twelve opioid drugs into Lake County and Trumbull County, OH.

223. There are two versions of this chart for each County. One version is a stacked bar chart in which the height of a colored section of each bar corresponds to shipments by each Distributor Defendant according to the color-coded legend. The second version of the chart is a line graph in which each Distributor Defendant's shipments into each County are reflected by the same color-coding as the stacked bar chart.

- **Appendix 10C: All Distributor Defendants, Combined and Individually, 12 Opioid Drug Distribution by Drug Code**

224. Using ARCOS Data produced by the DEA for 2006-2014 and Distributor Defendants' Transactional Data for the periods before 2006 and after 2014, I plot all Distributor Defendants' shipments of oxycodone, hydrocodone, and "other" opioid drugs into Lake County and Trumbull County, OH in Dosage Units. "Other" opioid drugs include codeine, dihydrocodeine, fentanyl, hydromorphone, levorphanol, meperidine, morphine, opium powdered, oxymorphone, and tapentadol.

225. The stacked bar charts illustrate the Dosage Units of each drug identified in the color-coded legend. The vast majority of Dosage Units each month in Lake County and Trumbull County, OH is in oxycodone and hydrocodone.

- **Appendix 10D: All Seller 12 Opioid Drug Distribution, by Zip Code and by Drug**

226. Using public ARCOS Retail Drug Summary Reports, I plot all shipments of oxycodone and hydrocodone into the U.S., Ohio, and all zip-codes in Ohio from 1997 to 2019 in MME.

227. The stacked bar charts illustrate the MME of each drug identified in the color-coded legend. Measured by MME, most of the opioids shipped into Lake County and Trumbull County, OH to be oxycodone and hydrocodone.

228. ARCOS Retail Drug Summary Reports report State and 3-digit zip-code information. County boundaries do not coincide precisely with 3-digit zip-code boundaries. These charts - and any other chart, figure or analysis using ARCOS Retail Drug Summary Reports - use the 3-digit zip-codes.

- **Appendix 10E: Individual Defendant Oxycodone Distribution in Lake County and Trumbull County, OH, by Total Dosage, Total MME, Total Drug Base Weight**

229. Using ARCOS Data produced by the DEA for 2006-2014 and Distributor Defendants' Transactional Data for the periods before 2006 and after 2014, I plot each Distributor Defendants' shipments of oxycodone into Lake County and Trumbull County, OH monthly in Dosage Units, MME and base weight. There are 42 charts of this type.

- **Appendix 10F: Individual Defendant Hydrocodone Distribution in Lake County and Trumbull County, OH, by Total Dosage, Total MME, Total Drug Base Weight**

230. Using ARCOS Data produced by the DEA for 2006-2014 and Distributor Defendants' Transactional Data for the periods before 2006 and after 2014, I plot each Distributor Defendants' shipments of hydrocodone into Lake County and Trumbull County, OH monthly in Dosage Units, MME and base weight. There are 60 charts of this type.

- **Appendix 10G: Oxycodone and Hydrocodone Distribution to Individual Pharmacies by All Distributors**

231. Using ARCOS Data produced by the DEA for 2006-2014 and Distributor Defendants' Transactional Data for the periods before 2006 and after 2014, I plot all distributors' shipments of oxycodone and hydrocodone to each pharmacy that received oxycodone or hydrocodone from any of the Distributor Defendants in Lake County and Trumbull County, OH in Dosage Units, MME and drug weight. Shipments made by distributors other than non-defendants, AmerisourceBergen Drug, Cardinal Health and McKesson Corporation are aggregated into the "Other" category. There are 372 charts of this type.

- **Appendix 10H: Pharmacy Reports**

232. Using ARCOS Data produced by the DEA for 2006-2014 and Distributor Defendants' Transactional Data for the periods before 2006 and after 2014, I tabulate and report Dosage Units, MME and drug weight shipped to retail and chain pharmacies in Lake County and Trumbull County, OH. I list the pharmacies in each county sorted by total MME. For each year, I report the Dosage Units and drug weight of oxycodone, hydrocodone, morphine, and

codeine and the Dosage Units and MME of the twelve non-treatment drugs received by each pharmacy from each Distributor. For comparison purposes, I list the average pharmacy MME in the county and the state each year and each pharmacy's percentile rank by MME in the state each year.

233. The Pharmacy Report is 492 pages long.

- **Appendix 10I: Distributor Reports**

234. Using ARCOS Data produced by the DEA for 2006-2014 and Distributor Defendants' Transactional Data for the periods before 2006 and after 2014, I tabulate and report the total Dosage Units per capita by year and by state. I rank states by average Dosage Units per capita over the 2006-2014 period and plot the 25 states with the highest average Dosage Units per capita.

235. I tabulate and report the total MME per capita by year and by state and rank states by average MME per capita over the 2006-2014 period and plot the 25 states with the highest average MME per capita.

236. I tabulate and report the MME and Dosage Units each year and totaled over the 2006-2014 period and market shares over the 2006-2014 period for each Distributor. I further break down the Distributors' annual shipments and total shipments and market share over the 2006-2014 period into the Distributors' individual DEA numbers.

237. The Distributor Report is 257 pages long.

- **Appendix 10J: Oxycodone and Hydrocodone Distribution to Individual Pharmacies by Defendant**

238. Using ARCOS Data for 2006-2014 and Distributor Defendants' Transactional Data for the periods before 2006 and after 2014, I plot

shipments of oxycodone and hydrocodone to individual pharmacies by Distributor Defendant and by drug strength. The report is 1,448 pages long.

- **Appendix 11: Opioid Top Down Exhibits**

239. Using ARCOS Data for 2006-2014, I show the opioid shipment into U.S., Ohio, and the two counties, Lake and Trumbull counties. The Opioid Top Down report is 1,027 pages long.

- **Appendix 12: Other Exhibits**

240. I created some reports employing a different layout using the numbers in Appendix 10, Appendix 11 or the tables/figures of this expert report.

XII. Conclusion

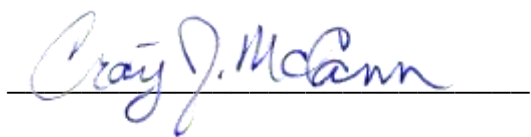
241. Based upon my comparison of the ARCOS Data produced by the DEA, the public ARCOS Retail Drug Summary Reports, I conclude that - after correcting a relatively small number of records - the ARCOS Data produced by the DEA is complete and reliable.

242. The ARCOS Data can be used to identify transactions into a state, county, zip code or individual pharmacy meeting certain criteria as I have illustrated above.

243. I reported the results of applying the non-exhaustive set of algorithms for flagging transactions to the transactions attributable to Distributor Defendants and Chain Pharmacy Defendants.

244. I reported the results of applying the non-exhaustive set of algorithms for flagging opioids dispensed by the Chain Pharmacy Defendants.

245. I continue to review documents and gather information and reserve the right to update my analysis and opinions based upon that further review of documents and based on any new information including, possibly, reports of other experts - I may receive.

A handwritten signature in blue ink, reading "Craig J. McAnn", is written over a horizontal line.

Signature of Expert

Appendix 1 Craig McCann Resume



Craig McCann, PhD, CFA
Principal

CRAIGMCCANN@SLCG.COM

703-246-9381

Key Qualifications

Dr. McCann is Principal, Securities Litigation and Consulting Group, Inc. He is experienced in securities class action litigation, financial analysis, investment management and valuation. Dr. McCann has taught graduate investment management at Georgetown University and at the University of Maryland, College Park. He held a Series 7 and a Series 63 NASD. Dr. McCann is a Chartered Financial Analyst.



Dr. McCann received a B.A. and an M.A. in Economics from the University of Western Ontario and a Doctorate degree in Economics from the University of California, at Los Angeles. Dr. McCann's fields of graduate study were industrial organization, mathematical economics and information and uncertainty. His dissertation examined the incidence of golden parachutes and their effect on stock prices. After receiving his doctorate degree, Dr. McCann taught economics at the University of South Carolina.

Prior to founding Securities Litigation and Consulting Group, Dr. McCann was Director at LECG and Managing Director, Securities Litigation at KPMG. Dr. McCann was a senior financial economist at the Securities and Exchange Commission. There he focused on investment management issues and contributed financial analysis to numerous investigations involving alleged insider trading, securities fraud, personal trading abuses and broker-dealer misconduct.

Dr. McCann was a Senior Consultant at a consulting firm where he managed projects involving alleged securities fraud, insider trading, and market manipulation. These projects included analysis of materiality, causation, damages and class certification. In addition, he has consulted on transfer pricing, breach of contract, labor and antitrust cases as well as on various regulatory matters.

Dr. McCann has published in the *Alternative Investment Analyst Review*, *Financial Services Review*, *Investments & Wealth Monitor*, *Journal of Alternative Investments*, *Journal of Applied Corporate Finance*, *Journal of Asset Management*, *Journal of Business Valuation and Economic Loss Analysis*, *Journal of Computational Finance*, *Journal of Derivatives*, *Journal of Derivatives & Hedge Funds*, *Journal of Financial Transformation*, *Harvard Business Review*, *Journal of Index Investing*, *Journal of Investing*, *Journal of Legal Economics*, *Journal of Real Estate Portfolio Management*, *Journal of Retirement*, *Journal of Risk* and *Journal of Wealth Management*. He has testified in state and federal court, in NASD, NYSE, JAMS and AAA arbitration proceedings and before the United States Senate and has been quoted in the *New York Times*, *Wall Street Journal*, *Washington Post*, *Bloomberg Markets*, *Reuters*, *Boston Globe*, *Bond Buyer*, *American Banker*, *Money Magazine*, *Kiplinger Retirement Report*, and *Crain's Investment News*.

Craig J. McCann
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Professional Experience

SECURITIES LITIGATION AND CONSULTING GROUP, INC.

2000 - *Principal*
Provides expert consulting and testifying in securities class actions, investment management, labor and valuation disputes.

NAVIGANT CONSULTING, INC. / LECG

1999-2000 *Director*
Provided expert consulting and testifying in complex litigation.

KPMG llp

1997-1999 *Managing Director, Securities Litigation*
Directed projects in complex litigation.

UNIVERSITY OF MARYLAND, COLLEGE PARK

1995-1998 *Adjunct Professor of Finance*
Taught graduate investment management.

GEORGETOWN UNIVERSITY

1996 *Adjunct Professor of Finance*
Taught graduate investment management.

NATIONAL ECONOMIC RESEARCH ASSOCIATES

1995-1997 *Senior Consultant*
Directed projects in the economics of complex securities litigation.

VIRGINIA TECH

1995-1997 *Adjunct Professor of Economics*
Taught graduate managerial economics.

U.S. SECURITIES AND EXCHANGE COMMISSION

1994-1995 *Professional Fellow and Acting Associate Chief Economist for Policy*
Reviewed Commission initiatives and coordinated research in support of Chief Economist.
Conducted research into portfolio performance, personal trading and quantitative risk measures.
Provided financial analysis in support of enforcement.

ECONOMIC ANALYSIS CORPORATION

1993-1994 *Senior Economist*
Directed projects involving analysis of vertical and horizontal practices, mergers, and general business damages.

U.S. SECURITIES AND EXCHANGE COMMISSION

1992-1993 *Academic Fellow*
Conducted research into the valuation and expensing of employee stock options, reviewed policy proposals and supported enforcement actions.

UNIVERSITY OF SOUTH CAROLINA, COLLEGE OF BUSINESS

1987-1992 *Assistant Professor*
Taught economics, antitrust and public policy towards business at undergraduate, masters, MBA and doctorate levels.

Craig J. McCann
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Education

UNIVERSITY OF CALIFORNIA, LOS ANGELES

1989 Ph.D., Economics

1986 M.A., Economics

UNIVERSITY OF WESTERN ONTARIO

1983 M.A., Economics

1982 B.A., Economics

Chartered Financial Analyst

Series 7 NASD Registration (1997-1999)

Series 63 NASD Registration (1997-1999)

Professional Activities

American Economic Association

American Finance Association

Chartered Financial Analyst Institute

Washington Society of Investment Analysts

Testimony, Depositions, Reports and Affidavits

Federal Court

In Re National Prescription Opiate Litigation United States District Court, Southern District of West Virginia, Civil Action No. 3:17-01362 and 3:17-01665.

Deposition, September 1, 2020.

Expert Report, August 3, 2020.

Frieda Mae Rogers v. Wilmington Trust Company et al United States District Court, District of Delaware, Case No. 18-116-GMS.

Trial Testimony, February 27, 2020.

Deposition, September 20, 2019.

Expert Report, July 26, 2019.

USA v. James W. Millegan, US District Court, District of Oregon, Portland Division, Case No. 3:19-cr-00528-IM

Expert Report, January 16, 2020.

In Re National Prescription Opiate Litigation United States District Court, Northern District of Ohio, Eastern Division, Case No. 17-MD-2804 (DAP).

Deposition, May 9-10, 2019.

Second Supplemental Expert Report, April 15, 2019.

Supplemental Expert Report, April 3, 2019.

Expert Report, March 25, 2019.

Securities and Exchange Commission v. RPM International, Inc. et al, United States District Court, District of Columbia, Case No. 1:16-cv-01803 (ABJ)

Deposition, April 23, 2019.

Rebuttal Expert Report, December 20, 2018.

Expert Report, November 2, 2018.

Craig J. McCann
(page 3)

Gary and Caryl Luis et al v. RBC Capital Markets, LLC, United States District Court, District of Minnesota, Case No. 0:16-cv-3873-SRN-TNL

Deposition, February 21, 2019.

Expert Report, October 20, 2018.

Peaker Energy Group, LLC et al v Cargill Incorporated et al, United States District Court Eastern District of Louisiana, Case No. 2:14-CV-02106.

Deposition, October 28, 2016.

Expert Report, August 5, 2016.

Ernest O. Abbit et al v ING U.S.A Annuity and Life Insurance Company et al, United States District Court, Southern District of California, Case No: CV 05-6838

Declaration, April 7, 2016.

Deposition, March 13, 2015.

Expert Report, February 20, 2015.

Patsy Chambers, et al v North American Company for Life, United States District Court for the Southern District of Iowa Central Division, No. 4:11-CV-00579-JAJ-CFB

Reply Expert Report, April 22, 2015.

Deposition, February 27, 2015.

Supplemental Expert Report, January 30, 2015.

Expert Report, August 18, 2014.

Deposition, July 29, 2014.

Expert Report, March 17, 2014.

Vida F. Negrete, et al v. Allianz Life Insurance Company, United States District Court, Central District of California, Case No: CV 05-6838

Declaration, November 1, 2013.

Deposition, May 1, 2012.

Expert Report, March 9, 2012.

Hearing Testimony, October 5, 2011.

Declaration, September 15, 2011.

Deposition, May 27, 2011.

Supplemental Declaration, March 31, 2011.

Deposition, October 29, 2008.

Declaration, July 25, 2008.

Second Supplemental Declaration, September 18, 2006.

Supplemental Declaration, July 16, 2006.

Declaration, May 26, 2006.

The Municipal Corporation of Bremanger, et al v Citigroup, Inc. et al, United States District Court, Southern District of New York, Civil Action, Civil Action No. 09-CV-7058.

Declaration, July 13, 2012.

Deposition, April 18, 2012.

Rebuttal Expert Report, March 28, 2012.

Expert Report, February 29, 2012.

Bank of America, N.A. v JB Hanna et al, United States District Court, Western District of Arkansas, Civil Action, Civil Action No. 10-5220

Deposition, April 16, 2012.

Expert Report, March 19, 2012.

Craig J. McCann
(page 4)

In re: Federal Home Loan Mortgage Corp. (Freddie Mac) Securities Litigation, United States District Court, Southern District of New York, Civil Action 09-MD-2072 (MGC)

Hearing Testimony, October November December 2011.

Rebuttal Expert Report, September 14, 2011.

Deposition, August 2, 2011.

Expert Report, June 30, 2011.

Susan Antilla v. L. J. Alfes & Co., Inc., United States District Court, District of Connecticut, No. 3:09-CV-2128-VLB.

Deposition, December 20, 2011.

Expert Report, August 12, 2011.

In re: International Management Associates, LLC, United States Bankruptcy Court, Northern District of Georgia, Atlanta Division, Case No. 06-62966.

Declaration, December 16, 2011.

Expert Report, July 7, 2011.

Thomas Todd Martin, III et al v Wachovia Bank, NA et al, United States District Court, Northern District of Alabama, Case No.: CV-09-902464

Expert Report, June 17, 2011.

Corporate America Credit Union v Joseph Herbst, et al, United States District Court, Northern District of Alabama, Case No.: CV-09-J-2126-S

Rebuttal Expert Report, May 23, 2011.

Sierra-Sonora Enterprises, Inc. et al v Domino's Pizza, LLC et al, United States District Court, District of Arizona, NO. 2:10-cv-00105-JAT

Expert Report, August 24, 2010.

Houston Police Officer's Pension System v. State Street Bank and Trust Company and State Street Global Advisors, Inc United States District Court, Southern District of Texas, Houston Division, No. 08-05442-RJH

Declaration, July 1, 2010.

Deposition, May 10, 2010.

Rebuttal Expert Report, March 19, 2010.

Expert Report, January 15, 2010.

Akanthos Capital Management, LLC, et al v CampusCredit Holdings Corporation, United States District Court, Northern District of Georgia, Atlanta Division, No. 1:10-CV-844-TCB

Declaration, May 7, 2010.

Securities and Exchange Commission v. Kederio Ainsworth et al, United States District Court, central District of California, Eastern Division, Civil Action No. EDCV08-1350 VAP(OPx)

Deposition, February 2, 2010.

Supplemental Expert Report, January 5, 2010.

Expert Report, December 11, 2009.

Florence Smith v National Western Life Insurance Company United States District Court, Middle District of Pennsylvania, Civil Action no. 08-2119

Expert Report, January 4, 2010.

City of Cedar Rapids and Cedar Rapids/Linn county Solid Waste Agency v. Wells Fargo Brokerage Services, LLC United States District Court, Northern District of Iowa, Cedar Rapids Division, No. ____

Rebuttal Expert Report, December 2, 2009.

Expert Report, September 3, 2009.

Craig J. McCann
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Daniel G. Schmidt, III v Wachovia Bank, N.A. United States District Court, Southern District of Texas, Houston Division, No. 08-05442-RJH

Deposition, February 25, 2010.

Expert Report, October 30, 2009.

In Re Midland National Insurance Co. Annuity Sales Practices Litigation, United States District Court, Central District of California, No. MDL No. 07-1825 CAS (MANx).

Deposition, September 12, 2009.

Supplemental Declaration, June 19, 2009.

Deposition, January 8, 2008.

Declaration, October 31, 2007.

Deposition, July 27, 2007.

Declaration, July 16, 2007.

Declaration, July 2, 2007.

Declaration, June 29, 2007.

Securities and Exchange Commission v. Biosail Corporation et al, United States District Court, Southern District of New York, Civil Action No. 08 CIV 02979 (LAK)

Expert Report, July 2, 2009.

CountryMark Cooperative, LLP, v Morgan Keegan & Company, Inc., United States District Court, Southern District of Indiana, Case No: 1:08-cv-00118-RLY-JMS

Expert Report, April 6, 2009.

Any J. Straily et al v UBS Financial services, Inc., United States District Court, District of Colorado, Case No: 07-cv-00884-REB-KMT

Deposition, February 22, 2009.

Supplemental Expert Report, January 16, 2009.

Expert Report, January 16, 2009.

Securities and Exchange Commission v. Competitive Technologies, et al, United States District Court, District of Connecticut, Civil Action No. 304-CV-1331 JCH

Trial Testimony, October 7, 2008.

Trial Testimony, November 15, 2007.

Deposition, February 22, 2006.

Expert Report, January 30, 2006.

In Re American Equity Annuity Practices and Sales Litigation, United States District Court, Central District of California, No. MDL No. CV-05-6735-CAS (MANx).

Deposition, July 24, 2008.

Declaration, April 21, 2008.

In re Alstom SA Securities Litigation, United States District Court, Southern District of New York, Case No: 03-CV-6595 (VM).

Affidavit, January 4, 2008.

Vida F. Negrete, et al v. Fidelity and Guaranty Life Insurance Company, United States District Court, Central District of California, Case No: CV 05-6837.

Declaration, January 22, 2008.

Declaration, December 26, 2007.

Deposition, August 28, 2007.

Declaration, July 23, 2007.

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Yoscin (Kevin) Ma et al v Merrill Lynch & Co., Inc. and Irene S. Ng, United States District Court, Southern District of New York, Case No. 06 CV 15497.

Expert Report, December 24, 2007.

Dale Sakai v Merrill Lynch Life Insurance Company, United States District Court, Northern District of California, Case No: CV 06-2581.

Deposition, December 10, 2007.

Expert Report, October 26, 2007.

Securities and Exchange Commission v. Louis E. Rivelli, et al, United States District Court, District of Colorado, Civ. 05-CV-1039 RPM-MJW

Deposition, March 3, 2008.

Expert Report, October 8, 2007.

Kevin Lamkin, et al v. UBS PaineWebber, Inc., United States District Court, Southern District of Texas, Civil Action No. H-02-0851

Deposition, February 28, 2007.

Expert Report, June 1, 2006.

Carmen Migliaccio, et al. v. Midland National Life Insurance Company, United States District Court, Central District of California, Case No: CV 05-6838.

Deposition, February 13, 2007.

Declaration, December 28, 2006.

Gary Yokoyama, et al. v. Midland National Life Insurance Company, United States District Court, District of Hawaii, Case No. 05-00303 MS KSC.

Deposition, November 20, 2006.

Declaration, November 10, 2006.

Declaration, May 4, 2006.

Samuel Cooper, et al v. Pacific Life Insurance Company et al, United States District Court, Southern District of Georgia, Case No. CV 203-131

Deposition, September 12, 2006.

Expert Report, July 5, 2006.

United States of America v. Jamie Olis, United States District Court, Southern District of Texas, Criminal Number H-03-217.

Expert Report, December 23, 2005.

David Henderlight and Christine Henderlight v. AmSouth Bank, United States District Court, Eastern District of Tennessee, Knoxville Division Civil Action No: 3:02-CV-169.

Deposition, July 7, 2005.

Expert Report, January 18, 2005.

United States of America v. Bernard J. Ebbert, United States District Court, Southern District of New York, Docket S4 02 Cr. 1144 (BSJ).

Expert Report June 8, 2005.

In Re: Kaiser Group International, Inc. et al., United States Bankruptcy Court for the District of Delaware, Case Nos. 00-2263 to 00-2301 (MFW).

Declaration, May 29, 2005.

United States of America v. Shawn P. McGhee, United States District Court, District of Eastern Virginia, Docket 04-495.

Expert Report March 4, 2005.

Craig J. McCann
(page 7)

Walnut Capital Partners et al. v Key Bank / McDonald Investments, Inc., United States District Court, Western District of Pennsylvania, Case No. 03-CV-0284.

Affidavit, February 14, 2005.

Deposition, September 8, 2004.

Supplemental Expert Report July 2, 2004.

Expert Report June 1, 2004.

Securities and Exchange Commission v. David Gane et al United States District Court, Southern District of Florida Miami Division, Civil Action No.03-61553.

Trial Testimony, December 10, 2004.

Deposition August 2, 2004.

Expert Report July 20, 2004.

Simon Falic et al v Legg Mason Wood Walker, Inc., United States District Court, Southern District of Florida, West Palm Beach Division Civil Action No. 03-80377.

Expert Report, October 19, 2004.

Securities and Exchange Commission v. David W. Butler United States District Court, Western District of Pennsylvania, Civil Action No. 00-1827.

Trial Testimony September 21, 2004.

Expert Report January 9, 2003.

Deposition, October 26, 2001.

Expert Report October 15, 2001.

United States of America v. Franklin C. Brown United States District Court, Middle District of Pennsylvania CR-02-146-02.

Trial Testimony, August 6, 2004.

Expert Report July 19, 2004.

United States of America v. Jeffrey R. Anderson United States District Court, District of Eastern Virginia, Docket 1:03-CR-444.

Expert Report January 2, 2004.

United States of America v. Scott H. Miller United States District Court, District of Eastern Virginia, Docket No. 03-443-A.

Expert Report December 3, 2003.

In re: World Access, Inc. Securities Litigation, United States District Court, Northern District of Georgia Atlanta Division, 1:99-CV-0043-ODE.

Rebuttal Expert Report August 8, 2003.

Expert Report June 27, 2003.

In re: Pediatric Services of America, Inc. Securities Litigation, United States District Court, Northern District of Georgia Atlanta Division.

Expert Report November 19, 2001.

Affidavit, October 13, 2000.

United States of America v. Paul F. Polishan United States District Court, Middle District of Pennsylvania No.3: CR-96-274.

Trial Testimony November 15, 2001.

Expert Report November 5, 2001.

Craig J. McCann
(page 8)

Kantishna Mining Company, Inc. et al v. Gail Norton et al United States District Court, District of Alaska F98-007 CV.

Declaration, June 1, 2001.

Expert Report and Declaration, April 17, 2001.

H. James Griggs et al v. Pace American Group, Inc., Coopers & Lybrand L.L.P., et al United States District Court, District of Arizona.

Trial Testimony, March 13, 2001.

Deposition, December 4, 2000.

Expert Report, November 14, 2000.

David Lesser, et al v. Quadramed Corporation United States District Court, District of Eastern Virginia No: 00 Civ. 606-A.

Expert Report, September 8, 2000.

John Tenaglia and The Tenaglia Family Partnership v. A.F. Best Securities et al, United States District Court, Southern District of Florida.

Expert Report, March 31, 2000.

UMG Recordings, Inc. et al v. MP3.com, Inc., United States District Court, Southern District of New York, No:00 Civ. 0472.

Expert Report, August 8, 1999.

Jonathan Bekhor et al v. Josephthal Holdings et al, United States District Court, Southern District of New York, No: 96 Civ. 4156.

Deposition, September 30, 1999.

Expert Report, August 20, 1999.

John Shane and Beth Goodman v. Tokai Bank, United States District Court, Southern District of New York, No:96 Civ. 5187.

Trial Testimony, October 23, 24 1997.

Deposition, October 19, 1997.

Expert Report, October 18, 1997.

State Court

State of Washington v. CLA Estate Services, Inc., King County Superior Court, Washington, No. 18-2-06309-4 SEA

Trial Testimony, November 18, 2020.

Deposition, August 7, 2019.

Expert Report, June 14, 2019.

Steven Varela v Ryan Mayer No. 20-2-02929-31, Superior Court of Washington for Snohomish County.

Declaration, November 16, 2020.

In Re Opioid Litigation, 400000/2017 Case Nos. County of Suffolk, 400001/2017, County of Nassau, 400008/2017; and New York State, 400016/2018

Hearing Testimony, August 19, 2020.

Deposition, January 27, 2020.

Expert Report, December 18, 2019.

Craig J. McCann
(page 9)

State of Ohio v McKesson et al. Court of Common Pleas, Madison County, Ohio, Case No. CVH20180055

Deposition, July 15, 2020.

Expert Report, February 22, 2020.

In Re Jeffrey Bryan Hall, State of Ohio, Franklin County, Case No. 04124-17-CR

Expert Report, December 31, 2019.

Wayne Harwell v Texas Next Capital, L.P., et al District Court, Bexar County, Texas, 166th Judicial District, Case No. 2017CI03737

Deposition, November 26, 2019.

Expert Report, February 21, 2019.

In Re: Lawrence J. and Florence A. DeGeorge Charitable Trust et al v Lawrence F. DeGeorge et al, In the Circuit Court of the 15th Judicial Circuit in and for Palm Beach County, Probate Division, Case No. 502012CP004397XXXXMB

Trial Testimony, August 21, 2017.

Douglas Ballinger, et al v Regions Investment Management Inc. et al In the Sixth Circuit Court of Tennessee for the Twentieth Judicial District at Nashville.

Deposition, April 26, 2017.

Expert Report, March 8, 2017.

Travis A. Medve v JP Morgan Chase Bank, N.A., et al, In the District Court of Harris County, Texas, 61st Judicial District, Cause No. 2015-38122

Deposition, February 24, 2017.

Expert Report, December 5, 2016.

Jack Loperena v Steve Antry, et al, In the District Court of Tulsa County, State of Oklahoma CJ-2013-03058

Trial Testimony, June 10, 2016.

Deposition, November 4, 2015.

Roberta Moll v Resnick Investment Advisors, LLC Superior Court, Judicial District of Stamford/Norwalk State of Connecticut, CV 13-6019201S

Deposition, March 11, 2016.

Expert Report, November 3, 2015.

Frances Brillhard, et al v Morgan Asset Management Inc. et al In the Circuit Court of Tennessee for the Thirteenth District at Memphis, Shelby County, Case No: DC-09-14448.

Deposition, February 20, 2015.

Expert Report, January 2, 2015.

Purdue Avenue Investors L.P. et al v Morgan Keegan & Co. Inc, et al, In the District Court, Dallas County, Texas, 101st Judicial District, Case No: DC-09-14448.

Trial Testimony, October 16, 2014.

Deposition, August 22, 2014.

Expert Report, July 15, 2014.

Francis P. Maybank v BB&T Corporation, et al, State of South Carolina, County of Greenville, Court of Common Pleas, C.A. No. 2011-CP-23-8578.

Trial Testimony, June 19, 2014.

Deposition, February 7, 2014.

Craig J. McCann
(page 10)

Robert L. McDonald v. Camarind, Magee & Fife et al, In The Court of Common Pleas of Allegheny County, Pennsylvania, Case No. CD-11-016862.

Expert Report, July 11, 2013.

Commonwealth v. Brett B. Weinstein, Esquire, et al. No. 239 M.D. 2006, *Commonwealth v. Estate Planning Advisors Corp, et al*. No. 740 M.D. 2004, and *Commonwealth v. Brett B. Weinstein, Esquire, et al*. No. 576 M.D. 2001, Commonwealth Court of Pennsylvania.

Expert Report, April 8, 2013.

Firefighters Retirement System v Regions Bank et al, State of Louisiana, Nineteenth Judicial District Court for the Parish of East Baton Rouge, Docket No. 56874, Division 25.

Expert Report, November 1, 2012.

Expert Report, July 20, 2012.

C. Randall Lewis, Receiver v. Steve Taylor, District Court, Denver County, Co., Case No. 2011CV2071.

Affidavit, November 1, 2012.

Expert Report, October 8, 2012.

In Re International Textile Group, Inc. Merger Litigation, State of South Carolina, County of Greenville, Court of Common Pleas, C.A. No. 2009-CP-23-3346.

Deposition, October 24, 2012.

Supplemental Expert Report, October 19, 2012.

Supplemental Expert Report, July 27, 2012.

Deposition, December 8, 2011.

Expert Report, July 20, 2011.

Deposition, May 13 and May 14, 2011.

Expert Report, April 1, 2011.

Lennar Corporation et al v Briarwood Capital, LLC et al Circuit Court, Miami-Dade County, CACE 08-55741 CA 40

Deposition, September 18, 2012.

Expert Report, August 16, 2012.

Susan W. Gore v Robert Gore et al Chancery Court, Delaware, C.A. No. 4237-VCN

Rebuttal Expert Report, September 7, 2012.

Expert Report, June 27, 2012.

Woodbridge Holdings, LLC v Prescott Group Aggressive Small Cap Master Fund et al, Circuit Court, Broward County, CACE 09-64811.

Trial Testimony, May 31, 2012.

Rebuttal Report, May 23, 2011.

Deposition, May 4, 2012.

Rebuttal Report, April 24, 2011.

Expert Report, April 2, 2011.

Pursuit Partners, LLC and Pursuit Management, LLC v. UBS AG Securities LLC et al, Superior Court, Judicial District of Stamford-Norwalk at Stamford No. X05-CV-08-4013452-S

Deposition, June 7, 2011.

Expert Report, May 5, 2011.

Craig J. McCann
(page 11)

Petition of Bank One Trust Company, N.A. For Instruction and Construction of Trust, District Court, Tulsa County, State of Oklahoma, Case No. PT-2006-013

Trial Testimony, April 19 and May 19, 2011.

Supplemental Expert Report, November 16, 2009.

Deposition, December 15, 2008.

Expert Report, June 13, 2008.

BB&T Asset Management, Inc., et al v Frederick V. Martin, Virginia Circuit Court for the City of Norfolk Case No. CL07006153-00

Expert Report, August 15, 2008.

Ross Gampel et al v Northern Trust Bank of Florida, Circuit Court, Broward County, CACE 05-18352 CA 31,

Deposition, April 17, 2008.

Cynthia Weiss v Robert Starman, et al In The Court of Common Pleas of Philadelphia County, August Term, 2006 NO. 3332

Expert Report January 23, 2008.

Salice Affiliates et al v Lattimore, Black, Morgan & Cain, P.C., Chancery Court, Tennessee Case No. 06-1500-IV

Deposition, December 5, 2007.

Expert Report, September 21, 2007.

Tafazzoli Family Limited, et al v. TradeStation Group, Inc. et al Circuit Court, Miami-Dade County, CACE 03-19815 CA 40.

Deposition, September 18, 2007.

Glenn Wall, et al v. James F. Bottoms, et al State Court of Fulton County, Georgia, Case No. 06VS091950F.

Deposition, June 19, 2007.

Andrew A. Allen Family Limited Partnership v. TradeStation et al Circuit Court, Broward County, CACE 03-014229.

Trial Testimony, May 4, 2007.

Deposition, February 20, 2007.

Remmora Investments v Robert Orr, Circuit Court of Fairfax County, VA No. 187948

Trial Testimony, November 20, 2006.

Deposition, October 9, 2006.

Gerardo Martin Demeratis Chaul, et al, v. Mohammed Abu-Ghazaleh, et al Circuit Court, Miami-Dade County, CACE 02-31670 CA 32.

Trial Testimony, November 6, 2006.

Deposition, October 11, 2005.

Expert Report July 15, 2005.

Calomiris v Calomiris, District of Columbia Superior Court, Civil Action No. 05-0004062

Deposition, October 11, 2006.

Jack Holtsberg and Elaine M. Holtsberg v. Citigroup et al Circuit Court, Palm Beach County, CACE 50 2004CA000837

Affidavit, August 28, 2006.

Craig J. McCann
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Majestic Enterprises v. Northern Trust Bank of Florida Circuit Court, Broward County, CACE 03-19243.

Deposition, July 26, 2006.

San Carlos Apache Tribe Government Employee's 401(K) v. A. Thomas Ullmann et al, Superior Court of Arizona, Case No. CV2005-005942.

Supplemental Expert Report, July 24, 2006.

Expert Report, June 30, 2006.

Patrick T. Noonan and Nancy J. Noonan v. Hackett Investment Advisors, Inc. et al, Superior Court of Arizona, No. CV2005-010186.

Deposition, June 21, 2006.

Stephen F. Johnston et al v. Baran Group et al, Superior Court of Fulton County, State of Georgia, Case No. 2004CV89313.

Deposition, June 28, 2006.

Expert Report June 9, 2006.

Carol Pomerantz et al v. Northern Trust Bank of Florida, et al Circuit Court, Broward County, CACE 02-015246-08.

Deposition, October 5 and October 12, 2005.

Carney Family Irrevocable Trust of 1999 v State Street Global Advisors, et al Superior Court of Commonwealth of Massachusetts, CIV. 03-2716 BLS 2

Deposition, June 21, 2005.

Trust Estate of Emanuel Rosenfeld, Settlor In The Court of Common Pleas of Philadelphia County, Orphans' Court Division, O.C. NO. 1664 IV OF 2002

Trial Testimony, May 3, 2005.

Expert Report April 8, 2005.

Evi U. Chamness et al v. Northern Trust Bank of Florida, et al Circuit Court, Broward County, CACE 03-001939-12.

Deposition, February 17 and February 18, 2005.

Affidavit, November 19, 2004.

Ponswamy Rajalingham et al v Urecoats International, Inc. et al, Circuit Court, Broward County, CACE 02-009324.

Deposition, March 1, 2004.

William J. Kerley v. McCullough, Sherrill LLP, et al State Court of Fulton County, State of Georgia, Civil Action No. 02VS028870E.

Affidavit, March 12, 2004.

Deposition, September 11, 2003.

Plantation Sales, Inc. dba Plantation Nissan/Volvo v Northern Trust Bank of Florida, Circuit Court, Broward County, CACE 02-006761 (05).

Deposition, February 19, 2004.

Century Business Services v Victor C. Moore, Court of Common Pleas, Cuyahoga County, Case No. 469291.

Trial Testimony, February 9, 2004.

Deposition, January 19, 2004.

Craig J. McCann
(page 13)

Michael B. Holt, as Trustee of the Mark E. Munro Charitable Remainder Unitrust, v. Merrill Lynch Trust Co., et al Superior Court of New Jersey, Docket # ESX-L-6713-02

Deposition, January 15, 2004.

Expert Report, September 8, 2003.

Jack E. Forbes v. A.G. Edwards, et al Circuit Court of Monongalia County, State of West Virginia, Civil Action No. 01-C-325

Trial Testimony, December 11, 2003.

Deposition, September 30, 2003.

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Dr. McCann has been invited to speak on prudent investment management practices, financial analysis in securities arbitrations, securities class action lawsuits and antitrust litigation on more than 65 continuing legal education and conference panels around the country.

April 5, 2021

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Appendix 2 Corrections to the ARCOS Data

246. I exclude certain transactions in the ARCOS Data and make corrections to other transactions in the ARCOS Data.

247. I make eight types of changes:

- a. I exclude duplicate transactions, when the same transaction was reported to ARCOS more than once by the same registrant.
- b. I exclude transactions where the Drug Code from the NDC dictionary is not one of the 14 opioids listed in Table 1.
- c. I exclude transactions where the Action Indicator code, Correction Number, or both suggest the reported transaction is erroneous.
- d. I exclude all transactions involving reverse distributors, analytical labs, importers, exporters, or researchers, because they are not relevant to my analysis. In addition, reverse distributors overstate the quantity of opioids shipped for destruction.
- e. I exclude transactions between two registrants, when the transaction is reported by the registrant receiving the shipment, because the transaction was already reported to ARCOS by the registrant sending the shipment.
- f. I exclude transactions with obvious errors in the reported Quantity.
- g. I exclude transactions with Transaction Code “X” (Lost-in-Transit), because “Transaction Code X is an explanatory

transaction code which does not affect an ARCOS registrant's inventory."⁴⁷

- h. I correct the Calculated Base Weight In Grams when it was calculated using an incorrect Ingredient Base Weight from the NDC dictionary.

A. Duplicate Transactions

248. The ARCOS Data had 610,381 duplicate transactions in December 2007 for one of the Cardinal Health distribution centers (Seller DEA Number: RC0221236). I kept one of each group of exact duplicate transactions so that there was only one record of each transaction.

249. The ARCOS Data had 158,062 duplicate transactions in August 2013 for four Walmart distribution centers (DEA Numbers: RW0133479, RW0165731, RW0199908 and RW0186278). I kept one of each group of exact duplicate transactions so that there was only one record of each transaction.

B. NDC Dictionary

250. Three of the fields in the ARCOS Data (NDC, Drug Code, and Drug Name) can also be found in the NDC Dictionary.⁴⁸ I checked the

⁴⁷ ARCOS Handbook, §5.8.3, p. 5-19.

⁴⁸ The DEA's NDC dictionary is available at www.deadiversion.usdoj.gov/arcos/ndc/ndcfile.txt. The dictionary is explained at www.deadiversion.usdoj.gov/arcos/ndc/readme.txt. The DEA updates the NDC dictionary monthly to correct errors, add new drug products, and remove discontinued drug products. I used the NDC dictionary updated on November 1, 2018, plus any discontinued drug products from earlier versions of the NDC dictionary in May 2018 – October 2018. An alternative NDC dictionary is maintained by the FDA (www.accessdata.fda.gov/scripts/cder/ndc/index.cfm).

accuracy of the Drug Code and Drug Name in the ARCOS Data by comparing those fields to the information in the NDC Dictionary.⁴⁹ When the two sources listed different Drug Codes or Drug Names, I updated the ARCOS Data to reflect the information in the November 2018 NDC Dictionary because the NDC Dictionary is updated monthly and I observe the DEA correcting errors in the NDC Dictionary. As a result of the comparison, I updated the Drug Code and Drug Name in 1,729 reported transactions (less than 0.0001% of the transactions).

251. After confirming the accuracy of the Drug Codes and Drug Names in the ARCOS Data, I found and removed 1,664 transactions (less than 0.0001% of the transactions) reported in the ARCOS Data which did not include any of the fourteen opioids in Table 1.

252. I also checked the accuracy of Calculated Base Weight in Grams in the ARCOS Data and found some NDCs for which the ARCOS Data incorrectly reported the Calculated Based Weight in Grams because it relied on an incorrect Ingredient Base Weight in the NDC Dictionary.⁵⁰ I reviewed the Ingredient Base Weights in the NDC Dictionary for all NDCs with Dosage Units in the ARCOS Data and flagged Ingredient Base Weights as potentially incorrect if the weight of the drug per dosage form (e.g., capsule, tablet, patch)

⁴⁹ I matched the ARCOS Data to the NDC Dictionary using NDC. For the Drug Code, I compared the first four digits of the Drug Code in the ARCOS Data to the first four digits of the Drug Code in the DEA's NDC dictionary. 156 NDCs in the ARCOS Data were not in the DEA's NDC dictionary.

⁵⁰ Calculated Base Weight in Grams is a function of the Quantity, Unit, and Strength fields in the ARCOS Data, and the Ingredient Base Weight in the NDC Dictionary.

was significantly different than other drug products with the same base drug and dosage strength.

253. For example, the NDC Dictionary reported that NDC 00056012770 (Percocet 5 mg tablets) contains 0.4483 milligrams of oxycodone per 100 tablets (0.004483 milligrams per tablet). Given other data in the NDC Dictionary, it is apparent that each 5-milligram tablet has 4.483 milligrams of oxycodone.⁵¹ I concluded that this NDC's Ingredient Base Weight in the NDC Dictionary and Calculated Base Weight in Grams in the ARCOS Data should be 1,000 times larger, and accordingly increased the Calculated Base Weight in Grams for this NDC.

254. I corrected the Calculated Base Weight in Grams of 14 NDCs in 285,891 reported transactions (approximately 0.06% of the reported transactions).⁵² The DEA's NDC Dictionary also includes the trade name of the drug product ("Trade/Product Name") and the dosage form ("Package Measure"), which I added to the ARCOS Data.

255. Finally, I checked the accuracy of the Dosage Unit in the ARCOS Data by using the NDC Dictionary. I multiplied the Quantity in the ARCOS Data by the Package Quantity in the NDC Dictionary. I did not find any discrepancies.

⁵¹ The drug's Ingredient Base Weight (e.g., 448.3 mg per 100 tablets) does not match the dosage strength (e.g., 500 mg per 100 tablets) because the Ingredient Base Weight is presented in terms of the anhydrous base form of the drug, while the dosage strength is presented in terms of the salt form of the drug. *See* p. 6-3 and Appendix 3 of the ARCOS Handbook.

⁵² Subsequent versions of the DEA's NDC dictionary appear to have been updated to correct the errors I found. Thus, each version of the DEA's NDC dictionary should be evaluated separately for necessary drug weight corrections.

C. Erroneous Transactions

256. I found and corrected four categories of erroneous transactions in the ARCOS Data.

1. *Transactions where ACTION_INDICATOR and CORRECTION_NO are both populated.*

257. The ARCOS Handbook explains that both the Action Indicator and Correction Number fields should never be populated for the same transaction. I found and deleted 59,223 such erroneous transactions (approximately 0.01% of the transactions).⁵³

2. *Adjustments to previously reported transactions.*

258. Reporters can adjust a previously reported transaction by submitting an adjusted transaction to ARCOS with ACTION_INDICATOR = “A” and submitting a deletion request for the originally reported transaction.⁵⁴ I identified 483,885 instances where the ARCOS Data included an adjusted transaction and either the originally reported transaction, the deletion request, or both.⁵⁵ I deleted the deletion request and the originally reported transaction.

3. *Deletions of previously reported transactions.*

259. Reporters can delete a previously reported transaction from ARCOS by re-submitting the transaction with ACTION_INDICATOR = “D”.⁵⁶ I identified 2,492 instances where the ARCOS Data included the

⁵³ See ARCOS Handbook, §7.4, p. 7-5.

⁵⁴ See ARCOS Handbook, §5.9.2, p. 5-20; §7.5.1, p. 7-13; and §7.8.2, p. 7-19.

⁵⁵ I identified the original record by matching the Reporter DEA Number, the Buyer DEA Number, the transaction month and year, the Drug Code, and the Transaction ID.

⁵⁶ See ARCOS Handbook, §5.9, pp. 5-19 through 5-20, and §7.5.1, p. 7-12.

deletion request and the original reported transaction.⁵⁷ I deleted the original transaction and the deletion request.

4. *Corrections of previously reported transactions.*

260. Reported transactions are sometimes rejected by ARCOS. The Reporter can then re-submit the transaction as a correction transaction. Correction transactions are identified by a record identifier in the CORRECTION_NO field.⁵⁸ I identified 17,320 instances where the ARCOS Data included both the rejected transaction and the corrected transaction. I kept the corrected transaction and deleted the originally reported transaction.⁵⁹

D. Transactions Involving Reverse Distributors, Analytical Labs, Importers, Exporters or Researchers

261. Reverse distributors, manufacturers and distributors ship opioids to analytical labs for destruction. Usually, manufacturers and distributors ship the opioids to the reverse distributors, who then ship them to the analytical labs. However, manufacturers and distributors sometimes ship opioids directly to analytical labs. Opioids shipped to reverse distributors or analytical labs are virtually never subsequently shipped to Dispensers.⁶⁰ I exclude transactions in the ARCOS Data involving reverse distributors or analytical labs because my analysis is focused on the flow of opioids to Dispensers.

⁵⁷ I identified the original record by matching the Reporter DEA Number, the Buyer DEA Number, the Transaction ID, the Transaction Date, the Order Form Number, the NDC, and the Quantity.

⁵⁸ See ARCOS Handbook, §5.16, p. 5-42 and §7.5, pp. 7-12 through 7-15.

⁵⁹ I identified the original record by matching the Reporter DEA Number, the Buyer DEA Number, the transaction month and year, the Drug Code, and the Transaction ID.

⁶⁰ The ARCOS Data reports 23,275 grams (Calculated Base Weight) of opioids were shipped from reverse distributors to Dispensers.

262. In addition, a number of transactions reported by reverse distributors have astronomical Calculated Base Weight in Grams either because the Unit code, used to specify the Quantity's unit of measurement, is set for kilograms when the most likely unit is milligrams for most opioids or micrograms for fentanyl, or because the Quantity itself is astronomical. For example, one pair of transactions reported by a reverse distributor in Georgia includes a receipt (coded P) of 45,902 metric tons of morphine from a manufacturer and a matched shipment for destruction (coded Y) to an analytical lab in Florida. In total, the ARCOS Data reflects 539,839 metric tons of opioids being shipped to analytical labs for destruction.

263. The ARCOS Data reports a relatively small quantity of opioids (91.3 metric tons of Calculated Base Weight) being sent to importers, exporters or researchers. I exclude transactions in the ARCOS Data involving importers, exporters or researchers because my analysis is focused on the flow of opioids to Dispensers.

E. Transactions between ARCOS Registrants

264. Transactions between ARCOS registrants should be reported twice in the ARCOS Data, once by each registrant. For example, a shipment from a manufacturer to a distributor should be reported once by the manufacturer and once by the distributor. To avoid double-counting, I keep the transaction reported by the registrant sending the shipment, and exclude the transaction reported by the registrant receiving the shipment.

F. Transactions with Obvious Errors in Quantity

265. I also exclude transactions with obvious errors in Quantity. For example, I exclude a single sale transaction of Hydrocodone/APAP tablets

from a distributor to a practitioner in the Northern Mariana Islands that has a Calculated Base Weight of 34 metric tons.

G. Transaction Code “X”

266. I exclude all transactions with Transaction Code “X”. The ARCOS Handbook explains that this code “is used by the seller to report the loss or theft of an in-transit shipment of a reportable controlled substance. It is reported **in addition** to the normal sales transaction (transaction code S). Transaction code X is an **explanatory** transaction code that does not affect an ARCOS registrant’s inventory.”⁶¹

267. Table 92 summarizes the effect of my exclusions and corrections on the number of transactions and the total Calculated Base Weight in Grams in the ARCOS Data.

⁶¹ ARCOS Handbook, §5.8.3, p. 5-19 (emphasis in original).

Table 92 Exclusions and Corrections to the ARCOS Data

	Change in # of Transactions	Change in Calculated Base Weight
Exclude Duplicate Transactions		
Cardinal Health Distributor, Dec. 2007 (DEA: RC0221236)	(610,381)	(1,747,195)
Walmart Distributor, Aug. 2013 (DEA: RW0133479, RW0165731, RW0199908, RW0186278)	(158,062)	(486,310)
Exclude Irrelevant Drug Codes	(1,664)	(53)
Exclude Erroneous Transactions		
Action Indicator and Correction No. Both Populated	(59,223)	(69,513,829)
Adjustments to Previous Transactions	(483,885)	(26,215,303)
Deletions of Previous Transactions	(2,492)	(2,218,380)
Corrections of Previous Transactions	(17,320)	(1,715,081)
Total Erroneous Transactions	(562,920)	(99,662,593)
Exclude Transactions Involving Reverse Distributors, Analytical Labs, Importers, Exporters or Researchers	(45,398,192)	(1,083,219,607,303)
Exclude Double-Reporting of Transactions between Registrants	(14,508,254)	(8,671,652,671)
Exclude Transactions with Obvious Errors in Quantity	(1)	(34,053,752)
Exclude Transaction Code "X" (Lost-in-Transit)	(3,729)	(116,009)
Fix Calculated Base Weight in Grams	-	(183,394,936)
Total Effect of Exclusions and Corrections	(61,085,141)	(1,092,210,234,512)

Appendix 3 Frequency and definition of transaction codes

Transaction Code	% of Transactions	Impact on Inventory	Description
S	88.43%	-	Sale, Disposition, or Transfer
Y	3.84%	-	Destroyed
Z	0.00%	-	Receipt by Government (seizures, samples, etc.)
Q	0.00%	-	Sampling (manufacturers only)
K	0.00%	-	Used in Preparations (manufacturers only)
N	0.00%	-	Nonrecoverable Waste (manufacturers only)
P	7.14%	+	Purchase or Receipt
R	0.55%	+	Return
V	0.03%	+	Unsolicited Return
G	0.00%	+	Government Supplied
L	0.00%	+	Reversing (manufacturers only)
M	0.00%	+	Manufactured (manufacturers only)
W	0.00%	+	Recovered Waste (manufacturers only)
J	0.00%	+	Return of Sample to Inventory (manufacturers only)
X	0.00%	n/a	Lost-in-Transit

Appendix 4 Corrections to DEA's NDC Dictionary

NDC	Original		Corrected	
	Quantity	Ingredient Base Weight in Grams	Quantity	Ingredient Base Weight in Grams
603388228	30	136.215000	30	0.136215
781560210	1000	0.000892	1000	4.460500
56012770	100	0.000448	100	0.448300
591245401	100	3,586.000000	100	3.586000
005913578**	1	0.000001	1	0.004500
107020184**	1	2.241250	1	0.002241
27280BH5701	10	0.570000	10	0.057000
52493019110	10	0.003020	10	0.030200
674330154**	1	0.000026	1	0.003027
674330888**	1	0.000705	1	0.021363
000440623**	1	0.000024	1	0.023900
00062A01628	28	0.695094	28	0.397197
00062A03228	28	0.695094	28	0.794394
000540438**	1	0.580400	1	290.200000
603389721	30	0.136220	100	0.454050
54868170000	100	0.448250	120	0.537900
54868496906	801	2.840670	100	0.354640
54868533803	30	0.201710	40	0.268950
58298054502	100	7,520.000000	100	75.200000

Appendix 5 MME Conversion Factors (from CDC)

Opioid Oral Morphine Milligram Equivalent (MME) Conversion Factors^{1,2}

Type of Opioid (strength units)	MME Conversion Factor
Buprenorphine film/tablet ³ (mg)	30
Buprenorphine patch ⁴ (mcg/hr)	12.6
Buprenorphine film (mcg)	0.03
Butorphanol (mg)	7
Codeine (mg)	0.15
Dihydrocodeine (mg)	0.25
Fentanyl buccal or SL tablets, or lozenge/troche ⁵ (mcg)	0.13
Fentanyl film or oral spray ⁶ (mcg)	0.18
Fentanyl nasal spray ⁷ (mcg)	0.16
Fentanyl patch ⁸ (mcg)	7.2
Hydrocodone (mg)	1
Hydromorphone (mg)	4
Levorphanol tartrate (mg)	11
Meperidine hydrochloride (mg)	0.1
Methadone ⁹ (mg)	3
>0, <= 20	4
>20, <=40	8
>40, <=60	10
>60	12
Morphine (mg)	1
Opium (mg)	1
Oxycodone (mg)	1.5
Oxymorphone (mg)	3
Pentazocine (mg)	0.37
Tapentadol ¹⁰ (mg)	0.4
Tramadol (mg)	0.1

¹ The MME conversion factor is intended only for analytic purposes where prescription data is used to calculate daily MME. It is to be used in the formula: Strength per Unit X (Number of Units/ Days Supply) X MME conversion factor = MME/Day. This value does not constitute clinical guidance or recommendations for converting patients from one form of opioid analgesic to another. Please consult the manufacturer's full prescribing information for such guidance. Use of this file for the purposes of any clinical decision-making warrants caution.

² National Center for Injury Prevention and Control. CDC compilation of benzodiazepines, muscle relaxants, stimulants, zolpidem, and opioid analgesics with oral morphine milligram equivalent conversion factors, 2016 version. Atlanta, GA: Centers for Disease Control and Prevention; 2016. Available at <https://www.cdc.gov/drugoverdose/media/>. For more information, send an email to Mbohm@cdc.gov.

³ Buprenorphine formulations with a FDA approved indication for Medication Assisted Treatment (MAT) are excluded from Medicare's Overutilization Monitoring System's opioid overutilization reporting.

⁴ The MME conversion factor for buprenorphine patches is based on the assumption that one milligram of parenteral buprenorphine is equivalent to 75 milligrams of oral morphine and that one patch delivers the dispensed micrograms per hour over a 24 hour day. Example: 5 ug/hr buprenorphine patch X 24 hrs = 120 ug/day buprenorphine = 0.12 mg/day = 9 mg/day oral MME. In other words, the conversion factor not accounting for days of use would be 9/5 or 1.8.

However, since the buprenorphine patch remains in place for 7 days, we have multiplied the conversion factor by 7 (1.8 X 7 = 12.6). In this example, MME/day for four 5 ug/hr buprenorphine patches dispensed for use over 28 days would work out as follows: Example: 5 ug/hr buprenorphine patch X (4 patches/28 days) X 12.6 = 9 MME/day. Please note that because this allowance has been made based on the typical dosage of one buprenorphine patch per 7 days, you should first change all Days Supply in your prescription data to follow this standard, i.e., Days Supply for buprenorphine patches= # of patches x 7.

⁵ The MME conversion factor for fentanyl buccal tablets, sublingual tablets, and lozenges/troche is 0.13. This conversion factor should be multiplied by the number of micrograms in a given tablet or lozenge/troche.

⁶ The MME conversion factor for fentanyl film and oral spray is 0.18. This reflects a 40% greater bioavailability for films compared to lozenges/tablets and 38% greater bioavailability for oral sprays compared to lozenges/tablets.

⁷ The MME conversion factor for fentanyl nasal spray is 0.16, which reflects a 20% greater bioavailability for sprays compared to lozenges/tablets.

⁸ The MME conversion factor for fentanyl patches is based on the assumption that one milligram of parenteral fentanyl is equivalent to 100 milligrams of oral morphine and that one patch delivers the dispensed micrograms per hour over a 24 hour day. Example: 25 ug/hr fentanyl patch X 24 hrs = 600 ug/day fentanyl = 60 mg/day oral morphine milligram equivalent.

In other words, the conversion factor not accounting for days of use would be 60/25 or 2.4.

However, since the fentanyl patch remains in place for 3 days, we have multiplied the conversion factor by 3 (2.4 X 3 = 7.2). In this example, MME/day for ten 25 ug/hr fentanyl patches dispensed for use over 30 days would work out as follows:

Example: 25 ug/hr fentanyl patch X (10 patches/30 days) X 7.2 = 60 MME/day. Please note that because this allowance has been made based on the typical dosage of one fentanyl patch per 3 days, you should first change all Days Supply in your prescription data to follow this standard, i.e., Days Supply for fentanyl patches= # of patches X 3.

⁹ The CDC MME conversion factor to calculate morphine milligram equivalents is 3. CMS uses this conversion factor when analyzing Medicare population opioid use. CMS uses the graduated methadone MME conversion factors to calculate MME within the Overutilization Monitoring System (OMS) for identifying and reporting potential opioid overutilizers. https://www.cdc.gov/drugoverdose/pdf/calculating_total_daily_dose-a.pdf.

¹⁰ Tapentadol is a mu receptor agonist and norepinephrine reuptake inhibitor. Oral MMEs are based on degree of mu-receptor agonist activity, but it is unknown if this drug is associated with overdose in the same dose-dependent manner as observed with medications that are solely mu receptor agonists

Appendix 6 MME on Base Weight and on Label

268. The MME conversion factors are guides for prescribers to consider when switching from one drug to another, oxycodone to hydrocodone for instance. This is important since the potency (toxicity) varies across drugs. It also allows CDC to publish recommended daily caps on opioids in MME and then prescribers can use the conversion factors to know how many dosages at each strength can be prescribed. Although it is not precise that the potency ratio between oxycodone and hydrocodone is 1.5 to 1, but this is a rule of thumb that is useful in “the real world” where prescribers need to make mental or back of the envelope calculations.

269. I take DEA’s calculated base weight in grams in the processed ARCOS Data and use the CDC conversion factors to standardize and aggregate across opioids. The MME on Base Weight is also used by academia when analyzing the opioid market trends.⁶²

270. Doctors in the field are told to use these rough conversion factors to consider different drugs as the change from one drug or formulation to another. The conversion factors are applied to the labelled drug strength to get the MME on Label which is different than the MME on Base Weight. The conversion factors are rules of thumb and not scientifically precise measurements.

⁶² For example, Piper B., etc, Trends in Medical Use of Opioids in the U.S., 2006 – 2016. American Journal of Preventive Medicine 54:652-660 (available at [https://www.ajpmonline.org/article/S0749-3797\(18\)30066-7/fulltext](https://www.ajpmonline.org/article/S0749-3797(18)30066-7/fulltext)). See also Cabrera FF etc., 2019. Opioid distribution trends (2006–2017) in the US Territories. PeerJ 7:e6272 (available at <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6338096/pdf/peerj-07-6272.pdf>)

271. MME on Base Weight and MME on Label both generate precise but spuriously precise results. Both provide results that are almost identical in the big picture and over time although you do find difference at specific NDC level and using drug strength gives you slightly higher MME across the board than using calculated base weight in grams.

272. Without further confusion, I use MME on Base Weight when processing and summarizing the ARCOS Data, and Defendant Transactional Data, and MME on Label on the Defendant Dispensing Data.

Appendix 7 ARCOS Summary

273. This appendix summarizes opioid shipment transactions reported in the ARCOS Data by drug, by reporter's business activity, by buyer's business activity, and by year for Ohio and all its counties

274. This appendix is attached as a separate 271-page PDF.

Appendix 8 Flagged Transaction Reports

275. Appendix 8A shows the result of implementing various methodologies described in Section VII to identify transactions meeting specified criteria using the non-public ARCOS Data from 2006 to 2014 of each Distributor Defendant.

276. Appendix 8B shows the result of implementing various methodologies described in Section VII to identify transactions meeting specified criteria using the non-public ARCOS Data from 2006 to 2014 of each Chain Pharmacy Defendant.

277. This appendix is attached as a separate 2,623-page PDF.

Appendix 9 Processing the Dispensing Data

278. We have received data from CVS, Walgreens, Rite Aid, HBC and Walmart regarding their opioid dispensing activities in Lake and Trumbull counties, Ohio. The Dispensing Data is composed of prescriptions, with each line of data containing basic information about the prescriber, the dispensed drug, the dispensed quantity, the dispensing pharmacy and the patient receiving the prescription. Also provided are the date and time when the prescription was filled and the date when the prescription was written. The data range with respect to prescription filling time is January 2006-November 2019 for CVS and HBC, January 2006-December 2019 for Walgreens, January 2009-November 2019 for Rite Aid, and January 2006-April 2018 for Walmart.

279. The data provided by each defendant includes prescriptions on 8 opioid molecules: hydrocodone, oxycodone, morphine, fentanyl, methadone, tapentadol, hydromorphone and oxymorphone.⁶³ The data also reflects benzodiazepine and muscle relaxer prescriptions dispensed to any patient who also received an opioid prescription whenever the benzodiazepine or muscle relaxer prescription was dispensed within 14 days of the opioid prescription.

⁶³ The data also includes prescriptions of a combination drug with three ingredients: codeine, an opioid, carisoprodol, a muscle relaxer, and aspirin.

280. While the available data fields vary by defendant, the following is a list of common fields provided by all defendants that are most relevant to the identification of red flags of diversion.⁶⁴

- 1) The product name of the dispensed drug, for example, “HYDROCODONE/APAP 5MG/500MG TABS” or “OXYCONTIN 10MG TABLETS”.
- 2) National Drug Code (NDC) number of the dispensed drug.
- 3) The date when the prescription was filled by the pharmacy.
- 4) Dispense hour and dispense minute. It is not clear for some defendants whether these represent the time when the prescription was received by the pharmacy, the time when the prescription was picked up by the patient, or some other time in between.
- 5) Quantity dispensed. This is the dosage units of the drug dispensed.
- 6) Days of supply. This reports the number of days the prescription is intended to last for.
- 7) Number of refills authorized. This is the maximum number of refills allowed.
- 8) Refill indicator. This field is binary indicating refill or not for some defendants and takes an integer value for others where “0” stands for original, 1 for the first refill, 2 for the second refill, and so forth.

⁶⁴ Each of these data fields can take different names across defendants. For example, CVS uses “DAYS_SUPPLY_QTY” to represent the days of supply allowed for a prescription while Walgreens uses “fill_days_supply”. Similar fields can also take different values and have different data quality across defendants.

- 9) Method of payment. This indicates whether the prescription was paid for by the patient with cash or by a third-party payer. Some defendants disclose the identity of the third-party payer (e.g., Medicare, Medicaid, commercial insurance, etc) and others do not.
- 10) The date when the prescription was written by the prescriber.
- 11) Quantity prescribed. This is the dosage units of the drug prescribed.
- 12) Prescriber DEA number.
- 13) Prescriber National Provider Identifier (NPI) number.
- 14) Prescriber's full name.
- 15) Prescriber's zip code. This is the zip code of the prescribing physician's office. Some defendants provide 9-digit zip codes while others only provide 5 digits. Some but not all defendants provide the prescriber's street address.
- 16) Pharmacy's DEA number.
- 17) Pharmacy's store number.
- 18) Pharmacy's zip code. This is the zip code of the pharmacy. Some defendants provide 9-digit zip codes while others only provide 5 digits. Some but not all defendants provide the pharmacy's street address.
- 19) Dispensing pharmacist's full name.
- 20) Patient identifier. This is a unique identifier of the patient created by each defendant.

21) Patient's zip code. This is the zip code of the patient's residence. Some defendants provide 9-digit zip codes while others only provide 5 digits.

22) Patient's birth year. Some defendants hid the patient's birth year for those with at least 90 years old of age.

281. We identify the following data elements from external sources for each NDC number in the Dispensing Data and append them to the raw data. Our sources include the public NDC directory downloaded from the DEA's website and an internal NDC drug dictionary.

23) Drug type. This indicates whether the dispensed drug is an opioid, benzodiazepine or muscle relaxer.

24) Base drug. This indicates the molecule of the drug dispensed, for example, "hydrocodone", "alprazolam" or "carisoprodol".

25) Drug form. This indicates the dosage form of the drug dispensed, for example, "tablet", "capsule" or "patch".

26) Drug schedule. This indicates the DEA schedule of the drug dispensed and takes a value of either 2 (schedule II), 3 (schedule III), 4 (schedule IV) or N/A (non-controlled).

27) Dosage strength. This is the numerical strength of the dispensed base drug as described in the drug name, expressed in milligram (for tablets and capsules), milligram per milliliter (for liquid products) or milligram per hour (for patches). For example, the dosage strength field is equal to 5 for the drug "Oxycodone / Acetaminophen Tab 5-

325 MG”, 2 for “Morphine Sulfate Oral Solution 10 MG/5ML” and 0.1 for “Fentanyl TD Patch 72HR 100 MCG/HR”.

- 28) Brand name indicator. This is a dummy variable equal to 1 for brand name drugs and 0 otherwise.
- 29) ER indicator. This is a dummy variable equal to 1 for extended-release and controlled-release drugs and 0 otherwise.
- 30) Morphine Milligram Equivalent (MME) for opioid prescriptions. This is calculated as multiplying the dispensed dosage units by dosage strength and then by a MME conversion factor unique to each opioid molecule.

282. We also calculate the distances between patients and prescribers, patients and pharmacies and pharmacies and prescribers, and append these distances to each prescription in the Dispensing Data. The distances are geodesic distances between the coordinates of the centers of the 5-digit zip codes.

Appendix 10 Additional Expert Report Figures and Charts

283. This appendix is described in Section XI and attached as a separate 3,086-page PDF.

Appendix 11 Opioid Top Down Exhibits

284. This appendix is described in Section XI and attached as a separate 1,027-page PDF.

Appendix 12 Other Exhibits

285. This appendix is described in Section XI and attached as separate PDFs.

Appendix 13

286. This appendix is attached as a separate 3-page PDF.

Bates # or other source
CVS-INDAG-00016506
CVS-MDLT1-000029477
CVS-MDLT3-000006234
CVS-MDLT3-000011131
CVS-MDLT3-000033314
CVS-MDLT3-000088675
CVS-MDLT3-000120295
CVS-NYAG-000030693
CVS-NYAG-000036552
CVS-NYAG-000040732
HBC MDL00043243
HBC MDL00052112
HBC MDL00191292
RA DR22 0000551
Rite Aid OMDL 0029789
Rite Aid OMDL 0044309
Rite Aid OMDL 0044327
Rite Aid OMDL 0044351
Rite Aid OMDL 0044379
Rite Aid OMDL 0046051
Rite Aid OMDL 0046795
Rite Aid OMDL 0053211
Rite Aid OMDL 0053787
Rite Aid OMDL 0055419
Rite Aid OMDL 0056374
Rite Aid OMDL 0056486
Rite Aid OMDL 0056851
Rite Aid OMDL 0057376
Rite Aid OMDL 0060444
Rite Aid OMDL 0060966
Rite Aid OMDL 0076024
Rite Aid OMDL 0076599
Rite Aid OMDL 0077150
Rite Aid OMDL 0077969
Rite Aid OMDL 0078735
Rite Aid OMDL 0080790
Rite Aid OMDL 0083349
Rite Aid OMDL 0083409
Rite Aid OMDL 0084498
Rite Aid OMDL 0085553
Rite Aid OMDL 0086609
Rite Aid OMDL 0086806
Rite Aid OMDL 0086933
Rite Aid OMDL 0089495

Rite Aid OMDL 0092822
Rite Aid OMDL 0096292
Rite Aid OMDL 0098992
Rite Aid OMDL 0100514
Rite Aid OMDL 0100737
Rite Aid OMDL 0100756
Rite Aid OMDL 0103576
Rite Aid OMDL 0106540
Rite Aid OMDL 0106566
Rite Aid OMDL 0112656
Rite Aid OMDL 0122150
Rite Aid OMDL 0123954
Rite Aid OMDL 0124016
Rite Aid OMDL 0125253
Rite Aid OMDL 0130556
Rite Aid OMDL 0133845
SA AGI 00069237
WAGCASF00022008
WAGCASF00037675
WAGFLDEA00000467
WAGFLDEA00000609
WAGMDL00000360
WAGMDL00008071
WAGMDL00008100
WAGMDL00008104
WAGMDL00008110
WAGMDL00008119
WAGMDL00021306
WAGMDL00037521
WAGMDL00057261
WAGMDL00066617
WAGMDL00093367
WAGMDL00098623
WAGMDL00100077
WAGMDL00237690
WAGMDL00256710
WAGMDL00303475
WAGMDL00405921
WAGMDL00410257
WAGMDL00437788
WAGMDL00492867
WAGMDL00502238
WAGMDL00658674
WAGMDL00742666
WAGMDL00745753

WAGMDL00779778
WAGMDL00784105
WAGMDL00870319
WAGMDL00874131
WAGMDL00879025
WAGMDL00879313
WAGMDL00890004
WAGMDL00898040
WMT MDL 000042957
WMT MDL 000042987
WMT MDL 000069077
WMT MDL 000069117
WMT MDL 000069165
WMT MDL 000069745
WMT MDL 000891159
<i>East Main Street Pharmacy,</i> Affirmance of Suspension Order, 75 Fed. Reg. 66149-01, 2010 WL 4218766 (October 27, 2010)
<i>Holiday CVS, LLC, d/b/a/ CVS</i> <i>Pharmacy Nos. 219 and 5195 ,</i> Decision and Order, Fed Reg. Vol. 77, No. 198, pp 62316-62346, (October 12, 2012).
<i>Jones Total Health Care Pharmacy,</i> <i>LLC v. Drug Enf't Admin .</i> , 881 F.3d 823 (11th Cir. 2018); https://www.deadiversion.usdoj.gov/fed_regs/actions/2016/fr1110_3.htm
<i>Pharmacy Doctors Enterprises, Inc., v.</i> <i>Drug Enf't Admin .</i> , 789 Fed. Appx. 724, 730 (11th Cir. 2019)

**MCCANN'S ADDITIONAL
APPENDICES ARE AVAILABLE UPON
REQUEST**